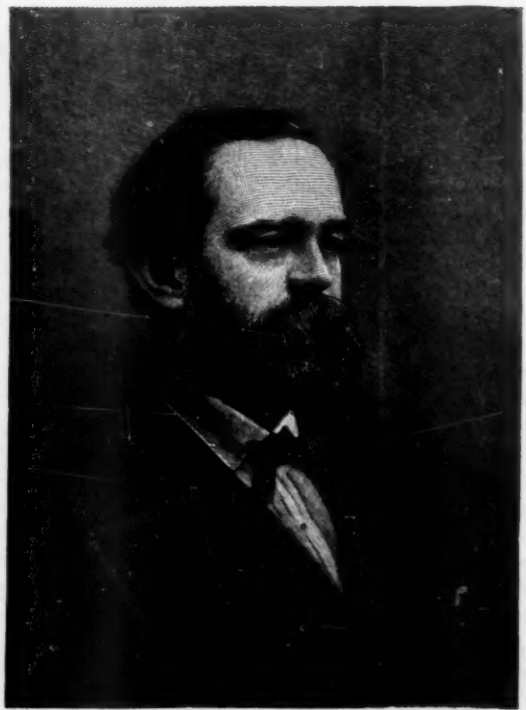
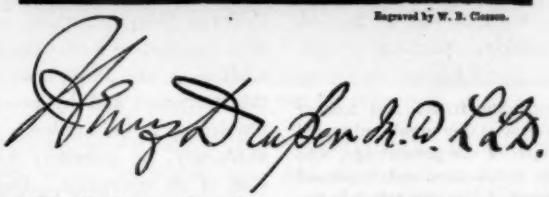
FRIDAY, FEBRUARY 16, 1883.

THE LATE DR. HENRY DRAPER.

DURING the past year, the National academy of sciences has lost by death seven out of its membership of less than one hundred, — Professor John W. Draper (the father of the subject of this notice), Admiral John Rodgers, Professor William B. Rogers, Hon. George P. Marsh, Gen. J. G. Barnard, Gen. G. K. Warren, and last, and saddest of all, Dr. Henry Draper.



Engraved by W. B. Closson.



The five first named were men advanced in years, whose work was substantially complete and finished, so that they had come to the natural end of honorable lives. Gen. Warren also had passed the age of fifty, and for some years had ceased to take any active part in scientific enterprise.

Dr. Henry Draper alone of all the seven was one from whom more even was to be expected in the future than the work he had already accomplished. He was cut off in the midst of his most successful achievements, at the very culmination of his course, just in the fulness of his strength. It is the simple truth, — what another has said already, — that "no greater calamity could have befallen American science than the recent and sudden death of Professor Henry Draper;" because he was now prepared by long experience, by the enthusiasm and confidence born of past success, by ripened judgment, and accumulated resources, for swifter advance than ever before in the important branch of research which he had made his own.

Only four days before he died, he entertained at his house a company of his scientific *confrères*, with a few other chosen friends. No one then present will ever forget the splendor and beauty of the scene, nor the genial hospitality of the host and his accomplished wife. Few of us ever heard his voice again. He was already suffering from a severe cold contracted by exposure in a storm during a hunting excursion among the Rocky Mountains (he had returned only a few days before), and the labor of preparing for this reception of his friends probably aggravated the trouble. That very night the hand of death was laid upon him, and after three days of suffering and struggle he was snatched away.

He was born in 1837, in Virginia; the second son of John William Draper, then at the

beginning of his brilliant career. The father was at the time a young professor of chemistry in Hampden-Sydney college; he had come to this country from England a few years before, to take a professorship at Boydton, Va., having been induced to come to the United States, partly by the solicitations of his Virginian relatives, and partly by considerations connected with his romantic marriage to a young Portuguese lady of noble birth. In 1839 the elder Draper accepted the chair of chemistry in the New-York university, and removed to the city with his family. Henry Draper, therefore, though by birth a Virginian, and mingling in his veins the blood of both the Anglo-Saxon and the Latin races, was yet entirely a New-Yorker in all his early associations and education, as well as in his later life.

He was educated in the schools of the city, and in the university with which his father was connected. He entered the freshman class at the age of fifteen, and went through the first two years of the college course. His instructors remember him as a bright, active youth, full of spirits, but with a strong taste and bent for scientific pursuits. At the beginning of his junior year he left the college for the medical school, and in 1858 he took his degree of M.D. with distinguished honor.

His education was conducted throughout under the immediate and loving supervision of his father, from whom he inherited such qualities of mind and temperament as qualified him pre-eminently for the work he was to do. A writer in 'Harper's weekly,' speaking of this, says, —

"He had for a companion, friend, and teacher from childhood, one of the most thoroughly cultivated and original scientific men of the present age, who attended carefully to his instruction, and impressed upon him deeply the bent of his own mind in the direction of science. The boy was, in fact, immersed in science from his youngest years; and not merely crammed with its results, but saturated with its true spirit at the most impressible period; he was taught to love science for the interest of its inquiries, and was early put upon the line of investigation in which he has won his celebrity. He inherited not only his father's genius, but his problems of research.

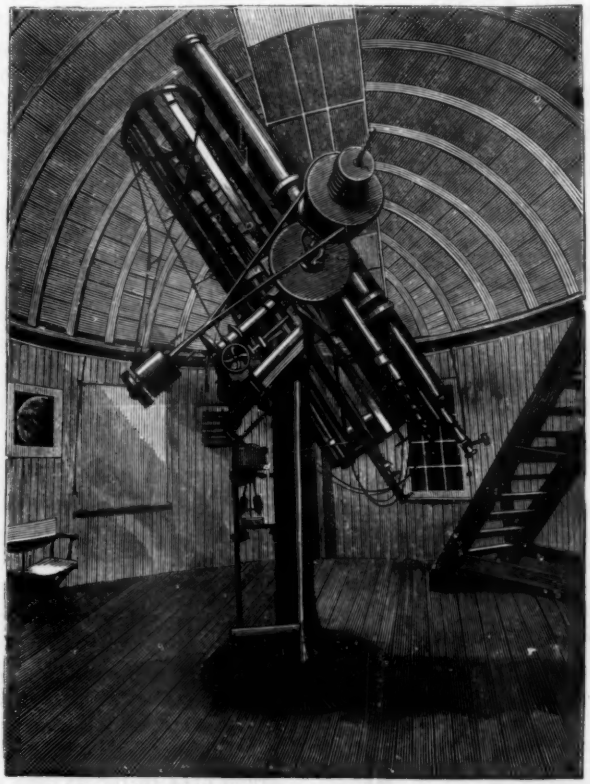
"Dr. John W. Draper was an experimental investigator of such fertility of resource, and such consummate skill, that the European *savants* always deplored his proclivity to literary labors, as a great loss to the scientific world. Henry Draper inherited from his father in an eminent degree the aptitude for delicate experimenting, and a fine capacity of manipulatory tact."

Nothing could be more beautiful than the relation and intercourse between this father and son in later years: on one side was the sincerest filial devotion, respect, and admiration; on the other, paternal pride and confidence; on both sides, the warmest affection, and perfect sympathy of purpose and idea.

Dr. Henry Draper began his researches before he left the college walls. His graduating thesis was a really valuable investigation of the functions of the spleen, and was conducted by means of microphotography, an art then only newly born. In the course of this work he discovered the great value of palladium protochloride in the darkening of collodion negatives. The year after his graduation was spent in Europe; and there, while he did not fail to appreciate and enjoy all that is interesting to every man of culture, still he was most interested in the places, methods, and instruments of scientific research. His visit to the great six-foot reflecting telescope of Lord Rosse, by far the largest ever constructed, gave to his ambition a stimulus and direction which influenced his whole life, and largely determined his career.

On his return he received an appointment in Bellevue Hospital, which he retained for sixteen months, with the intention of practising medicine. In 1860, however, he abandoned this purpose; and by accepting the chair of physiology in the academic department of the university, he definitely adopted the profession of an instructor. During the civil war his work was for a time interrupted by a short term of service in 1862 as surgeon of the twelfth regiment of New-York volunteers; but a military career had few attractions for him, and as soon as he was no longer needed he returned to the duties of his chair. In 1866 he was appointed to the professorship of physiol-

ogy in the medical school. He retained this post until 1873, when he resigned it, but continued to give the instruction in analytical chemistry in the academic department. At his father's death he was appointed to fill the vacant chair, and accepted the position; but only a few months before his death he resigned, and finally severed his connection with the university in order to give himself more entirely to research. At the time when he accepted the chair of physiology in the medical school, and became its manager, the institution had just lost its building by fire, with all its valuable collections. The young director immediately replaced them, largely by funds furnished by himself, and partly by assistance secured from others through his indomitable energy and skilful tact. The school, which seemed to be destroyed, was rehabilitated, and brought to its present state of flourishing prosperity.



THE TELESCOPES IN THE HASTINGS OBSERVATORY.

His resignation in 1873 was necessitated by the heavy labor and responsibility imposed upon him as managing trustee of the immense estate of his father-in-law, the late Courtlandt Palmer, whose daughter he had married in 1867.

As a lecturer and instructor he was eminently successful. Says a writer in the University quarterly (the 'college magazine' of the New-York university), —

"His lectures are so interesting and absorbing to his hearers, that the question of order, which in some recitation-rooms assumes large proportions, is hardly even thought of with him. After class, an eager group surrounds him; and every tap by inquiring students is followed by a rich stream of information from a mind whose varied treasures always lie at instant command."

But he was still more eminent and successful as an investigator. We have already mentioned his first essay of the sort, and it was soon followed by others more extensive. Immediately upon his return from Europe he began the construction of a fifteen-and-a-half inch reflecting telescope, and carried the work to a satisfactory conclusion. With it he took a photograph of the moon, fifty inches in diameter, the largest ever made, and one of the finest.

Encouraged by this success he aimed still higher, and built another reflector of twenty-eight inches aperture, which was completed in 1872. This, with its equatorial mounting and perfect driving clock, was wholly the work

of his own hands. It was intended and used successfully for the purpose of photographing the spectra of stars. As President Barnard has said, "it was probably the most difficult and costly experiment in celestial chemistry ever made." It was with this instrument

that in August, 1872, he first succeeded in obtaining a photograph of a star-spectrum, showing its characteristic lines: the star was Vega, and the lines were those of hydrogen. Since then he has taken the spectra of more than a hundred stars, and at the time of his death was preparing to push the work much farther. Most of the later photographs were made with an exquisite refractor of eleven and a half inches aperture, by Clark & Sons.

This telescope, which he has found much more convenient than the reflectors, is provided with a special correcting lens for photographic work; and it was with this that he made those wonderful photographs of the nebula of Orion, which were the fruit of his long and weary labors during the two last winters. For the most part he was accustomed to carry on his astronomical work in the summer, while residing at his country-seat on the Hudson; in the winter he generally spent most of the time in the city, and gave himself mainly to laboratory research. In 1872, as a first step towards the interpretation of stellar spectra, he made a photograph of the diffraction spectrum of the sun, extending from below G to O. Others have since then taken pictures of small portions of the spectrum on a larger scale; but his photograph still remains classical and standard, and is recognized as such, abroad as well as here.

In 1874 he was invited by the Transit of Venus commission, to superintend its photographic department; and he did so with such success, that on the completion of his labors the United-States government caused a special gold medal to be struck in his honor at the Philadelphia mint. Upon the face it bears the inscription, "Decori decus addit avito;" on the reverse, "Famam extendere factis, hoc virtutis opus."

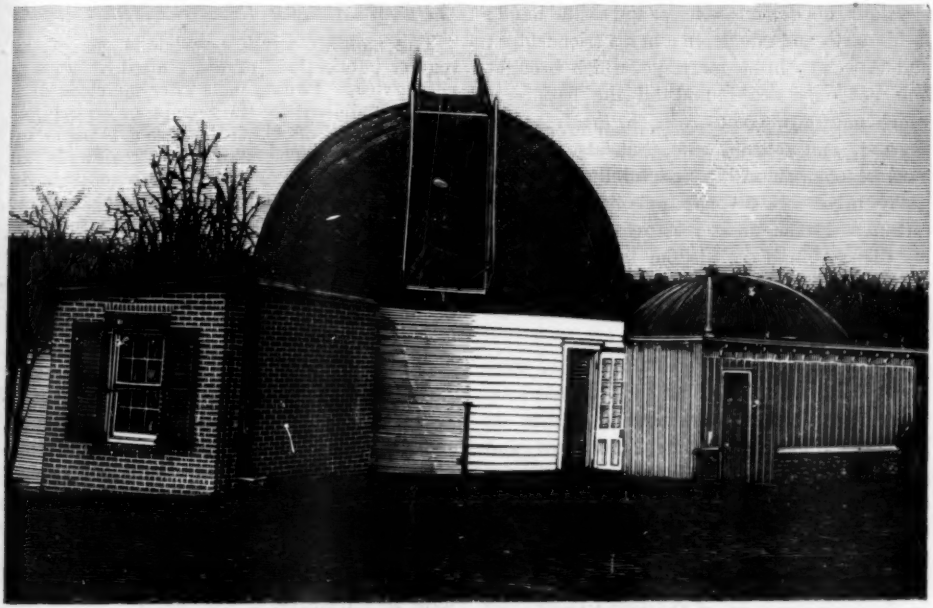
Next he took up his famous research as to the presence of the non-metals in the solar atmosphere, and in 1877 published his paper announcing the discovery of oxygen in the sun. The investigation was exceedingly protracted and laborious, and involved an expense of several thousand dollars: it was carried out by means of photography, several hundred plates having been made, which show the solar spectrum confronted with that of the gas. In these plates we find the diffuse, hazy, bright lines of the oxygen spectrum coinciding, not with *dark* lines of the solar spectrum, but with certain brighter bands or interspaces. How this can be, it is far from easy to explain, — why oxygen alone should act in this unprecedented way. Naturally there has been some scepticism and discussion as to the correctness and soundness of his conclusion; but no one with an unprejudiced mind can, we think, resist the evidence after careful examination of the plates, especially those obtained during his second, and still more

elaborate, investigation of the subject in 1878–79.

In the summer of 1878 Dr. Draper organized a party for the observation of the solar eclipse of July 29. His station was at Rawlins, Wyoming Territory; and he succeeded, as did many others, in getting a fine photograph of the corona: he also succeeded, as no one else did, in getting a photograph of its spectrum, which, however, at that time was almost simply continuous.

Smithsonian institution, is a work of great importance. In the different scientific journals of England and the United States, he has from time to time published numerous papers giving account of his different researches. Our space forbids a catalogue, but they are mostly enumerated in the obituary notice published in the January number of the Popular science monthly.

Considerable unpublished work remains behind. Among other things should specially be noted the ingenious contrivance by which



DR. DRAPER'S OBSERVATORY AT HASTINGS-ON-THE-HUDSON.

In 1881 he obtained photographs of the spectrum of the great comet of that year, and also of the nebula of Orion and its spectrum. These pictures of the nebula are among the most remarkable and interesting specimens of celestial photography in existence.

Dr. Draper was not a prolific writer; but every thing he wrote was valuable, — clear, logical, and effective. Early in his career he published an excellent text-book of chemistry; and his paper upon the construction of silvered-glass telescopes, published by the

he succeeded in compelling a prism of bisulphide of carbon to perform satisfactorily in spite of changing temperature; and the equally interesting invention for working the Edison incandescent lamp by means of a gas-engine, without the disagreeable fluctuation of light which usually accompanies the use of such an engine.

Dr. Draper was a member of the Century and Union league clubs, and occupied a high social position. With politics he did not meddle to any extent, though he was always

patriotic and interested in the public welfare. He was connected with numerous scientific bodies in the city and country, and with many abroad. Though one of the youngest members of the National academy of sciences, he was one of the most effective and influential. Last summer his *alma mater* and the University of Wisconsin honored themselves and him, by conferring upon him simultaneously, but independently, the degree of LL.D.

Excepting his early death, Dr. Draper was a man fortunate in all things: in his vigorous physique, his delicate senses, and skilful hand; in his birth and education; in his friendships; and especially in his marriage, which brought him not only wealth and all the happiness which naturally comes with a lovely, true-hearted, and faithful wife, but also a most unusual companionship and intellectual sympathy in all his favorite pursuits. He was fortunate in the great resources which lay at his disposal, and the wisdom to manage and use them well; in the subjects he chose for his researches, and the complete success he invariably attained.

In person he was of medium height, compactly built, with a pleasing address, and keen black eye which missed nothing within its range. He was affectionate, noble, just, and generous; a thorough gentleman, with a quick and burning contempt for all shams and meanness; a friend most kind, sympathetic, helpful, and brotherly; genial, wise, and witty in conversation; clear-headed, prudent, and active in business; a man of the highest and most refined intellectual tastes and qualities; a lover of art and music, and also of manly sports, especially the hunt; of such manual skill that no mechanic in the city could do finer work than he; in the pursuit of science, able, indefatigable, indomitable, sparing neither time, labor, nor expense.

His loss is lamented keenly, not only by those to whom it is a personal bereavement, but by every sincere lover of truth and science. It must be long before another can be found of such abilities, means, and versatility, to carry on his unfinished work.

But it is violating no confidence to add that his wife, who for fifteen years was his untiring assistant in all his labors, who knew all his plans, and thoroughly understood them too, now hopes and intends to find some way to have his work continued, to utilize the magnificent apparatus he had collected, and so to perpetuate his memory, and keep it forever green by providing for the accomplishment of his most cherished purposes: — Monumentum aere perennius.

Charles A. Young.

THE WEATHER IN NOVEMBER, 1882.

The monthly weather review is one of the regular publications of the United-States signal-service. Twenty days after the close of a month is allowed for the receipt of reports, at the expiration of which the review is made up and printed. The November review is an improvement over any of its predecessors, in being stitched and furnished with a neat cover, which contains the name of co-operating observers and of vessels whose officers furnish marine reports, and also a list of meteorological instruments, with the prices at which they may be obtained through the signal-office. The following may be mentioned as the noteworthy meteorological conditions of the month: —

The barometric pressure was nearly normal when compared with the November pressure of previous years. The number of minima sufficiently well marked to allow the charting of their paths is only five, an unusually small number, the average in former years being fourteen. Three of these depressions pursued an easterly track over the northern portion of the country, and two a north-easterly along the Gulf and Atlantic coasts. The latter were the most severe storms of the month.

The temperature was below the normal along the eastern coast and from the Rocky Mountains to the Pacific. In other portions the temperature was higher than the average. Frosts were frequently reported in all districts, the least number being three in the South-Pacific region; while temperatures above 90° F. were reported from Arizona and Texas. The month witnessed the closing to navigation of the upper Missouri and Mississippi rivers and the upper lakes.

There was a marked deficiency in rainfall in nearly the whole country, the principal exception being the middle Pacific coast. New England suffered most from lack of rain; the rainfall, including melted snow, amounting to

only 1.6 inches, the average for November in former years being 4.5 inches. Considerable snow was reported from northern districts, and a little from the southern states.

Among miscellaneous phenomena may be mentioned earthquake shocks, which occurred on the 7th in Wyoming, Colorado, Utah, and Kansas, and on the 14th in Missouri.

The most noteworthy feature of the whole month was the remarkable magnetic storm which occurred from the 16th to the 20th. It prevailed, not only throughout this country, but in Europe, and was characterized by extensive auroral displays. It was simultaneous with a large sun-spot, visible to the naked eye. The English journals have contained many articles upon this storm and its attendant features; but in this country extensive cloudiness prevented as complete auroral observations as would otherwise have been secured.

NEW TESTAMENT AUTOGRAPHS.

AN interesting and important application of the methods of the theory of probability to the criticism of the New Testament was made in a paper read by Mr. J. Rendel Harris, late a fellow of Clare College and a lecturer in the university of Cambridge, before the Philological society of Johns Hopkins university, at their meeting on the 5th of January: the results of which investigation will, if substantiated, form a new departure in textual criticism.

Attention was first drawn to the exact equality of the second and third epistles of St. John, each of which occupies 29 lines of type in the edition of Westcott and Hort; and it was remarked, that the text of these epistles probably represented an integral number of sheets of the original papyrus.

An examination was then made of the space occupied by the various books of the New Testament in the Vatican codex. This MS. is written in triple columns, each containing 42 lines to the column. Every book begins at the top of a column; but, strange to say, intead of ending according to a random distribution over the 42 lines of the columns, they show a preference for ending at the 27th or 28th lines.

Five epistles were shown to end on the 27th line, one on the 26th, and two on the 28th.

A calculation was made which showed that this was not the work of chance, but of law; and it was inferred that there was a commensurability of the books in question with one another, with the whole Vatican column, and the partial column of 28 lines.

From this was at once deduced, that the Vatican page is composed of nine smaller pages of papyrus arranged in a square, so that three go to a column, and three columns to the page. Each of these smaller pages was represented by the term V-page; so that a Vatican page is equivalent to the following notation: —

V	V	V
V	V	V
V	V	V

And, since any deviation from the form of papyrus found in the autographs would have resulted in the introduction of a random distribution of the endings, it was shown that the V-page for the books in question was approximately the page of the autograph.

A similar analysis for the Sinaitic codex, which has four columns to the page, and 48 lines to the column, revealed the existence of a smaller papyrus page employed by a number of other books. This page was represented by 12 lines of the Sinaitic column, and was denoted by S; so that the page of the MS. was equivalent to: —

S	S	S	S
S	S	S	S
S	S	S	S
S	S	S	S

By means of these two types the majority of the books of the New Testament were restored to the original sheets.

But even more remarkable was the application of the results of this inquiry to the purposes of textual criticism, and to the stichometry of the New Testament. For these we must refer to the forthcoming supplementary number of the American journal of philology, where it will be found demonstrated, that the celebrated passage of St. John in which is given the account of the woman taken in adultery is, in all probability, four lost pages of the original document of the Gospel; and that the account of the agony in the garden, which is also rejected by the critics, is a lost page of

the autograph of St. Luke. The details of the investigation will be found, with many other points of interest to New-Testament students, in the article above referred to.

INFLUENCE OF MAGNETISM ON CHEMICAL ACTION.[1]

More than a year ago I gave an account[2] of some experiments which I had performed with the object of determining whether magnetism exerts any influence on chemical action. I succeeded in getting what appears to me to be strong evidence in favor of the view that magnetism does, at least in one case, exert a marked influence on chemical action. The principal experiment upon which this conclusion is based may be briefly described here. A vessel made of thin iron (ferrotype-plates were used) was placed on the poles of a magnet, and a solution of sulphate of copper poured into it. Instead of getting a uniform deposit of copper on the bottom of the vessel, the metal was deposited in distinctly marked lines, the direction of which was at right angles to the lines of magnetic force. Further, directly over the poles, the deposit was uniform; and this uniform deposit was bounded by a band of no deposit, from one-sixteenth to one-eighth of an inch in width.

Since the first paper on this subject was published, I have spent a great deal of time in endeavoring to discover other cases of similar action, and to extend the observations in various directions, in the hope of reaching a satisfactory explanation of the phenomenon described. I shall soon give a full account of the work in the American chemical journal. In the mean time a condensed account is here given.

I should say at the outset, that the subject of this paper has frequently been discussed and experimented upon in past years. In 1847 Wartmann[3] summed up what had been done previous to that time, and also described some new experiments of his own. According to him, magnetism does not influence chemical action. His proof was furnished by two experiments. In the first, the electrolysis of water was carried on in a magnetic field, and the results compared with those obtained with the same apparatus without the magnet. The results were the same in both cases. In the second experiment, iron cylinders were placed in a solution of copper sulphate. Some of the cylinders were magnetized, and others were not. No difference was observed between the deposits formed. The author calls attention to the fact that his conclusion, that magnetism does not influence chemical action, differs from that of a number of earlier writers, among whom may be mentioned Schweigger, Döbereiner, Fresnel, Ampère, and Robert Hunt; but that, on the other hand, it agrees with that of Otto-Linné Erdmann, Berzelius, and the Chevalier Nobili.

Among the experiments referred to by Wartmann, those of Robert Hunt[1] are perhaps the most striking; and to these I turned my attention. Hunt states, that, when a concentrated solution of silver nitrate or of mercurous nitrate is placed on glass over the poles of a magnet, the salts crystallize out in curious lines, of which an illustration is given. While these experiments have no direct bearing on the question whether magnetism influences chemical action or not, I nevertheless repeated them. To my surprise, the effects described by Hunt were not obtained. The conditions were repeatedly changed, — the strength of the solutions, the strength and form of the magnets, the thickness of the glass plates, being varied; but under no conditions were the expected effects obtained. Some of the other experiments of Hunt were also repeated, but only with negative results. So that even the most positive statements of Hunt will require verification before they can be accepted in favor of his conclusion that magnetism influences chemical action and crystallization.

Among the experiments which I have performed since the publication of the first paper already referred to, may be mentioned the following: 1. The action of copper on zinc. In this case the magnet evidently exerted some influence on the action; causing apparently an accumulation of copper on the lines bounding the space directly above the poles. No lines between the poles like those obtained when copper acts on iron were observed. I am unable to say positively whether the faint figure observed in the zinc was due to an increased deposit of copper or to a lack of deposit. 2. Action of silver on zinc. Indistinct lines were observed, which appeared to be at right angles to the lines of force. These were obtained only when the solution of silver nitrate was quite dilute. 3. Action of copper on tin. The action was evidently modified by the presence of the magnet. 4. Action of silver on lead. No action was

[1] Abstract of a paper read before the National academy of sciences, at its semi-annual meeting in New York, Nov. 14–17, 1882.

[2] American chemical journal, iii. 157.

[3] Philosophical magazine, 1847 [3], 30.

[1] Philosophical magazine, 1846 [3], 281.

observed. 5. Action of silver on iron. A slight effect was produced.

It will thus be seen, that the first experiment described is the one which best exhibits the influence of the magnet. The question still remains, whether the striking effect observed is due to the influence of magnetism on the chemical action, or to some indirect influence of the magnet. An examination of the liquid while the action is going on shows clearly that there are currents in it. Small particles of dust, or any light material, on the surface of the liquid, are drawn towards the poles, and then move in circles above the poles, to the right above one, to the left above the other. We have hence electric currents in the liquid; and these revolve under the influence of the magnet, as we would expect them to. This action gives rise to a streaky condition of the liquid, and this may possibly account for the deposition of copper in the peculiar lines which have been described. I am unable to say whether this satisfactorily accounts for the fact, that the lines of deposit are at right angles to the lines of force; but, as far as I have been able to determine, it does not. Further, if the presence of the currents is the cause of the peculiar deposit of copper on iron, it would appear that the same kind of action should be observed whenever one metal is deposited upon another under the influence of a magnet. This, however, is not the case, as was pointed out above. The fact that the action takes place markedly in the case of iron, and only very slightly, if at all, with other metals, suggests, though it does not prove, that the action is in some way connected with the magnetized condition of the iron. Up to the present I have been unable to experiment with cobalt and nickel. Using nickel-plated brass, I did not succeed in getting any displacement of other metals from solutions by nickel in this condition. Experiments with these metals will of course be of special interest. If it can be shown that with them the same kind of action takes place as with iron, and that with non-magnetic metals it does not take place, the influence of magnetism directly on the chemical action would be practically demonstrated. The slight effects observed with other metals already described may possibly be attributed to the presence of small quantities of iron in the metals experimented upon.

Turning from the ridges of copper deposited on the iron, what is the cause of the space around the outline of each pole upon which no copper is deposited? It is sharply defined; and at the end of the operation it is bright, having remained entirely unaffected by the solution of copper sulphate. Here is evidently a region, not by any means inconsiderable, in which no chemical action has taken place. This can hardly be ascribed to the presence of currents in the liquid. The cause must, I think, be looked for in the magnetized condition of the iron; and I venture, though with misgivings, to suggest, that, the influence of the magnetism being most strongly felt in the iron at the outlines of the poles, these parts of the iron resist the action of the copper sulphate. We may imagine, that the molecules of iron in the regions immediately surrounding the poles are held more firmly than those which are less directly under the influence of the magnet, and that the interference with their motion protects them. Just as, in general, any cause which facilitates the motion of molecules facilitates chemical action, so, also, any cause which interferes with the motion of molecules would probably prevent chemical action either completely or partially. I recognize the crudeness of this suggestion. If there are any objections which can be raised against it, I shall be glad to be informed of them. In the mean time it may at least serve as a working hypothesis, and may lead eventually to a more satisfactory view. I intend to continue experiments on the subject under consideration. Unfortunately, the phenomena which can aid in the solution of the problem appear to be but few, and these do not readily lend themselves to quantitative treatment. The work will necessarily advance slowly, but I shall continue it as long as there appears to be any hope of getting results of value. IRA REMSEN.

ROTIFERA WITHOUT ROTARY ORGANS.

PROFESSOR JOSEPH LEIDY, in a paper recently published in the Proceedings of the Academy of natural sciences of Philadelphia, observes that the Rotifera, or wheel-animalcules, form a small class, abundant in kind, and found almost everywhere in association with algae and with infusorians to which they were formerly considered to belong. Later they were regarded as crustaceans, but now are looked upon as belonging to the group of worms. Their usual striking characteristic, the rotary disks, is not possessed by any well-marked crustacean. Among the Rotifera, however, there appear to be some which do not possess the rotary organs, and yet in all other respects conform in structure to ordinary forms.

Dujardin, Gosse, and Claparede have described rotifers which they regarded as destitute of rotary organs: but Cohn described one with these organs, otherwise resembling the form of Dujardin, and suspects that the latter made a mistake; and remarks that the existence of a rotifer without vibratile cilia would be an abnormal condition in the class. While the forms described by the three authors above named are open to the suspicion that they may possess rotary organs which were withdrawn at the time of

their observation, there can be no question that there are others which are entirely destitute of them, and have efficient substitutes. Of this character is Dictyophora vorax, discovered by Professor Leidy in 1857. The animal is oval, transparent, and fixed in its position. The interior exhibits the usual structure of rotifers, together with the powerful muscular pharynx armed with jaws, observed to be in frequent motion. From the truncated extremity of the body the animal projects a capacious delicate membranous cup more than half the size of the body. The cup is a substitute for the rotary disks of ordinary rotifers, and is used as a net to catch food. At will it is entirely withdrawn into the body with its prey. The animal feeds on smaller animalcules; and in one instance upwards of fifty of these, mostly entomostracans, were squeezed from the stomach. With extended net, the animal measures up to 1 mm. in length. It was found in the Schuylkill River, attached to stones and aquatic plants, and also was observed attached to the sides of an aquarium.

Mecznikow, in 1866, described a similar rotifer under the name of Apsilus lentiformis, found at Giessen, attached to the leaves of the Nymphaea lutea. It especially differs from Dictyophora in the possession of bristled tentacles, and a ganglion to the pouch. Recently, also, Mr. S. A. Forbes of Normal, Ill., has described a similar rotifer with the name of Cupelopagus bucinedax; but this Professor Leidy suspects to be the same as the Dictyophora.

Later Professor Leidy has discovered another remarkable form, which he has named, from the absence of rotary organs, and its restless habit, Acyclus inquietus. It was found attached to the stems of Plumatella, a ciliated polyp, on stones in the Schuylkill River. It was always single, enclosed in profuse bunches of the familiar rotifer Megalotrocha, from which it was rendered conspicuous by its larger size, resembling a giant in a crowd. For the most part, in general structure it resembles Megalotrocha; but as a substitute for the rotary disks of the latter, it possesses a large cup-like head prolonged at the mouth into an incurved beak. The cup is retractile and protrusile, contractile and expansile. When protruded and expanded, the mouth gapes widely, and the beak becomes more extended, but always remains incurved. The animal bends incessantly in all directions, and it contracts and elongates in accord with its surrounding associates. It frequently bends, almost doubling on itself, so as to bring its prehensile mouth within the play of the currents produced by the rotary disks of the Megalotrochae, while the mouth expands and contracts so as to grasp a portion of the food brought within its reach. The movements of the animal are somewhat of a grotesque character, and reminded the author of a zealous demagogue addressing a crowd, obsequiously bowing, and greedily accepting contributions. The length of Acyclus is up to 1.5 mm. in length. The embryo at the time of its escape from the egg is a worm-like body, having the mouth furnished with vibratile cilia.

The original paper is furnished with illustrations representing both Dictyophora and Acyclus.

In one instance Professor Leidy remarks, that he had the opportunity of seeing an individual of Plumatella, with outspread arms, and in its immediate vicinity a group of Megalotrochae with open disks and an Acyclus in its midst, together with two worms of the genus Dero, with extended and expanded branchial tails, all acting together in concert, apparently perfectly regardless of the presence of one another, — messmates partaking of the same repast.

RHYTHMIC MUSCULAR CONTRACTIONS.

Continuing those researches on the physiology of the contractile tissues to which we owe so much, Engelmann has lately been at work (*Pflüger's archiv*, xxix. 1882) on the arterial bulb of the frog's heart; selecting it as a muscular organ which contracts rhythmically on stimulation. Preliminary careful study with the aid of some of his pupils confirmed the result of all previous workers, that the bulb contains no nerve-cells. Löwit, however, just as Engelmann had finished his work, described a 'bulbus ganglion:' this led to a fresh histological examination, also fruitless, so that Engelmann finally asked Löwit to send him some of his preparations. These were received and examined. Engelmann unhesitatingly asserts that the supposed nerve-cells are nothing but endothelial elements and connective tissue corpuscles. The isolated arterial bulb is accordingly nothing but a mass of muscular, connective, and epithelial tissues; nevertheless, when filled with blood serum under a suitable pressure, it, like the apex of the ventricle, executes slow rhythmic pulsations. These cease in ten or fifteen minutes, but after a while recommence, and may continue for hours. A single sudden stimulus of moderate strength applied in any pause between two pulsations calls forth, not as in the case of the ventricle a single contraction, but a rhythmic series of such. A weaker stimulus leads to only one beat, or none. Any part of the musculature of the bulb has this property, even pieces cut off and so minute as to need a lens for their observation. It is therefore undoubtedly a property of the muscle elements themselves. The muscle is also conductive: a stimulus applied to a portion united only by a narrow uncut strand with another portion, will arouse contractions in the latter. The stronger the stimulus, up to a maximum limit, the greater the number of pulsations in the series which follows its application, and the less the intervals between the individual contractions of the series. The influence of successive stimuli at not too short (3–5″) intervals is like that observed by Bowditch on the ventricular apex. After long rest, irritability and contractility are diminished; if then equal successive stimuli be applied, of such strength that each only arouses one beat, each beat is more powerful than that which preceded it, until a maximum is reached; at the same time a weaker stimulus than that required at the end of the period of rest becomes sufficient to excite a contraction. Each pulsation nevertheless temporarily exhausts the muscle; if the stimuli follow at less than 2″ intervals, the successive results are smaller. The contraction is always maximal for the given condition of the muscle: a strong stimulus causes no more powerful contraction than a weak, provided the latter acts at all. As in other muscles, a stimulus in itself too weak to cause a contraction makes the organ more sensitive to succeeding stimuli. As a result of this, rapidly repeated (tetanizing) stimuli at first too feeble to influence the bulb may after a time make it give an occasional beat, and ultimately cause rhythmic pulsations: that is, practically continuous stimulation gives rise not to continuous but to periodic contraction. These experiments go far in support of the view which has been gaining ground for some time back, that the rhythm of the heart's action is due not to intermittence in the stimulation sent from its ganglia to its muscle fibres, but to a property of the cardiac muscle tissue itself. The paper also contains interesting experiments on the influence of warmth and cold, and of varied

pressure of its contents, upon the isolated arterial bulb. The most striking temperature observation is, that the bulb, when brought to heat-standstill at or a little above 40° C., will nearly always beat again if the temperature be still raised two or three degrees.

H. NEWELL MARTIN.

LETTERS TO THE EDITOR.

Algae and spray markings.

INCIDENTAL to a note in Nature (xxvii. 46) on Invertebrate casts *versus* algae in paleozoic strata, the writer would call attention to the fact, that he has seen many track-like markings made by dried seaweeds blown along the shore. In some cases a series of parallel indentations, as if some animal had walked along, were made by the stiff projections of the rolling plant. These algae tracks and markings are very similar to many fossil tracks which have been figured.

Forms similar if not identical with those described by Billings as Arenicolites spiralis from St. John's, Newfoundland, have been seen by the writer to be formed on the beach by the spray. This was especially observed last autumn at Marblehead Neck. The spray dashing over a projecting rock, and falling on the wet sands left by the retreating tide, produced a series of drop and ring like markings in the sand, varying in size from minute drops to those one or two inches in diameter. This corresponds, as regards size, with the specimens of Arenicolites collected by the writer at the Newfoundland locality. The common form of the larger spray markings is that of a ring, with a raised centre and a depressed border, surrounded by the displaced sand. The appearance is as if the drop fell like a partly closed bell of a jelly-fish, and then expanded outward in every direction, carrying the sand with it, but leaving the central portion untouched. These forms would probably be somewhat modified by the next tide, causing variations in the structure, if not obliterating the forms for the most part. As in Newfoundland, so on this modern beach, the impressions are seen crowded together, as well as singly. (See *Can. nat.*, (2), vi. 478; *Geol. survey Canada, pal. foss.*, ii. 77; *Amer. journ. sc.*, (3), iii. 223.)

M. E. WADSWORTH.

Cambridge, Mass., Jan. 9, 1883.

Geology of Lake Superior.

I am pleased to learn from a communication published in your number of Feb. 9, and signed A. R. C. Selwyn, that the present head of the Geological survey of Canada has arrived at conclusions with regard to the geology of the Lake-Superior region precisely similar to those reached and published by Foster and Whitney over thirty years ago.

That it would have been well for the Canada survey, and for geological science generally, if more attention had been paid by Mr. Logan and his assistants to the results of the survey carried on along the south shore of the lake by the U.S. geologists, during the years 1848 to 1850, will, it is thought, become apparent to every geologist who reads a work prepared by Dr. Wadsworth and myself, soon to appear in the bulletin of the Museum of comparative zoölogy, and entitled 'The azoic system and its subdivisions.'

J. D. WHITNEY.

Cambridge, Feb. 12, 1883.

Rock disintegration in hot, moist climates.

Some remarks of Nordenskiöld, in his 'Voyage of the Vega,' pp. 707–713, relating to precious stones, suggest the thought that the marked differences which occur as to the manner and rate of the weathering of granitic rocks at the north and at the south can hardly be so familiar to European scientific men as they are to American observers. At the south it is common enough to find soils that have been formed 'in place,' from the thorough and deep-seated chemical decomposition of the rocks on which they rest; while at the north, well-marked disintegration of this sort is rarely met with, even in places where the observer is not perplexed and confused by the mechanical results of glacial action. The subject has often been alluded to by American geologists, working in our southern states, notably by Professors Kerr of North Carolina, and Stubbs of Alabama, who have expressed themselves in the following terms: Speaking of the geologic formation which, "after hugging the east side of the Appalachian chain of mountains and forming some of the most valuable farming lands of the Atlantic states, enters the central eastern part of Alabama," Professor Stubbs says, "The rocks which by disintegration have given the soils of this section are mainly granites, gneisses, feldspars, hornblendes, mica-schists, etc.; and much the greater part of the section is covered by soils which have resulted from disintegration of the above-mentioned rocks *in situ*. And here I may remark a notable feature of these soils,—a feature which cannot fail to arrest the attention of every northern geologist: viz., that decomposition of these rocks in southern latitudes has proceeded much farther than with the same rocks in higher latitudes, and therefore has given us deeper soils. It is difficult to find in the north a soil over a few feet deep; while here it is not uncommon to find in railroad-cuts, wells, etc., disintegrated strata to the depth of thirty, fifty, or even seventy-five feet. This can be accounted for to a large extent by climatic influences. The warm waters, charged with carbon dioxide, percolating throughout the year the easily permeable strata, act continuously as a chemical agent in the work of disintegration; while farther north not only the amount of water, the temperature, and the chemical activity are reduced, but for one-half of the year the soil is locked up by frost from all access of decomposing agencies."

The influence of these soils of disintegration upon the agriculture of the regions in which they occur, has often been noticed; and their bearing upon the history of the use and manufacture of commercial fertilizers in this country is no less clearly marked. It would seem to be plain, that disintegration such as this, when accompanied with or followed by denudation, would readily account for the accumulation, and, so to say, concentration in 'pockets,' or other places of rest, of any heavy or refractory minerals which were originally contained, dispersed, in the native rock; and that among the multitude of individuals thus thrown together there would be much greater likelihood of finding superior specimens than can be obtained by searching the comparatively meagre deposits that are formed at the north.

The statement of Nordenskiöld, above referred to, is here given in condensed form.

"Precious stones occur in Ceylon mainly in sand-beds, especially at places where streams of water have flowed which have rolled, crumbled down, and washed away a large part of the softer constituents of the sand, so that a gravel has been left which contains more of the harder precious-stone layer than the originally sandy strata or the rock from which they originated. Where this natural washing ends, the gem collector begins. He searches for a suitable valley, digs down a greater or less depth from the surface to the layer of clay mixed with coarse sand resting on the rock, which experience has taught him to contain gems. . . . The yield is very variable, sometimes abundant, sometimes very small. . . . Sapphires are found much more commonly than rubies. . . . The precious stones occur in nearly every river valley which runs from the mountain-heights in the interior of the island down to the lowland. . . . But some one perhaps will ask, Where is the mother-rock of all these treasures in the soil of Cey-

lon? The question is easily answered. All these minerals have once been embedded in the granitic gneiss which is the principal rock of the region" (and which weathers readily). . . . "In weathering, the difficultly decomposable precious stones have not been attacked, or attacked only to a limited extent: they have therefore retained their original form and hardness. When in the course of thousands of years, streams of water have flowed over the weathered rock, the softer constituents have been for the most part changed into a fine mud, and as such washed away, while the hard gems have only been inconsiderably rounded and little diminished in size. The current of water, therefore, has not been able to wash them far away from the place where they were originally embedded in the rock; and we now find them collected in the gravel-bed, resting for the most part on the fundamental rock which the stream has left behind, and which afterwards, when the water has changed its course, has been again covered by new layers of mud, clay, and sand. . . . Of all the kinds of stones which are used for ornaments, there are both noble and common varieties, without there being any perceptible difference in their chemical composition. The most skilful chemist would have difficulty in finding, in their chemical composition, the least difference between corundum and sapphire or ruby; between common beryl and emerald; between the precious and common topaz; between the hyacinth and the common zircon; between precious and common spinel: and every mineralogist knows that there are innumerable intermediate stages between these minerals which are so dissimilar, though absolutely identical in composition. This gave the old naturalists occasion to speak of ripe and unripe precious stones. They said that in order to ripen precious stones the heat of the south was required. This transference of well-known circumstances from the vegetable to the mineral kingdom is certainly without justification. It points, however, to a remarkable and hitherto unexplained circumstance; namely, that the occurrence of precious stones is, with few exceptions, confined to southern regions. . . . Another remarkable fact in connection with precious stones is, that most of those that come into the market are not found in the solid rock, but as loose grains in sand-beds. True jewel-mines are few, unproductive, and easily exhausted. From this, one would be inclined to suppose that precious stones actually undergo an ennobling process in the warm soil of the south."

To the writer of this note, it seems more reasonable to suppose that the greater abundance of noble gems in southern climates should be attributed to the more active and thorough-going disintegration which occurs in those regions, and to the consequent — comparatively speaking — enormous accumulation and concentration of the precious minerals, as above suggested. Other things might be far from being equal, and yet the chance of finding a stone of price be greater in a heap of ten thousand rough jewels than in a collection which contains but a few score.

Bussey Institution. F. H. Storer.

The November aurora in California.

Auroras are exceedingly rare phenomena in southern California; yet we had the pleasure of witnessing one Nov. 17, at which time a great electric storm raged over North America and Europe. The photographic traces during the time from Nov. 10 to Nov. 20 are very interesting; as they have preserved a perfect record of the twitchings and jerkings, large and small, fast and slow, to which the magnets were subjected during this time.

A slight shock of earthquake was reported here on Jan. 23, about 5.20 P.M. I was on the street, and did not feel it; and so far as I can detect no harm was done at the observatory. Marcus Baker.

Los Angeles, Cal., Jan. 26.

TRYON'S CONCHOLOGY.

Structural and systematic conchology: an introduction to the study of the Mollusca; by George W. Tryon, Jr. Vol. I. Philadelphia, *the author.* 1882. 8 + 312 p., cuts, 22 pl. 8°.

We have received the first volume of Mr. Tryon's new work (to be completed in three volumes), intended as an introduction to the study of the mollusks. This portion consists of some general considerations, a description of the anatomy, habits, and economy, distribution in space and time, notes on nomenclature, classification and collection, of mollusks. Assistance in paleontological matters has been rendered by Prof. Angelo Heilprin. The work is well printed and bound; but the plates, though not so bad as in the 'Manual' of the same author, contain mostly inferior renderings from old and familiar figures, produced by processes which cannot be made to yield really good results. The map is very badly drawn, and besides this, through 'overlaying,' resulting from folding and inferior or excessive ink, has become nearly illegible. Mr. Tryon frankly disclaims authorship for his compilation, which is derived almost wholly from Woodward's well-known 'Manual,' and the earlier parts of Dr. Paul Fischer's 'Manuel de conchyliologie,' now in process of publication. Since both these works are accessible at a total price less than that of the first volume of Mr. Tryon's book, it is not clear why the latter should exist. Perhaps the future volumes will explain.

Meanwhile we do not feel that any very warm welcome should be extended to a work of compilation so destitute of perspective as this. Though not what the author would have made it had Lovèn's work on the dentition of mollusks appeared ten years earlier, Woodward's book is nevertheless a thoroughly coherent manual, in which the parts retain proper proportions to each other and to the whole. There are many statements in it which are now obsolete, or supplemented by more precise, fuller, or more accurate information. Groups not recognized by Woodward have attained their majority, and no longer train timidly in the leading-strings of a few bold specialists. The study of embryology, histology, and general anatomy, has entirely changed the situation so far as the point of view is concerned; but the great merits of Woodward, as originally published, are as conspicuous as ever. The work of Dr. Fischer is directly on Woodward's lines, and embodies of course much of his information; but it is not a mere revision, an ill-considered conglomeration like that of Tate, nor such a compilation as the present one of Tryon's. Silk and leather are good in their places; but man does not patch one with the other, or, doing so, repents of it. Mr. Tryon's first volume appears to us to resemble a mosaic of granite, chalk, precious stones, and mud, which is not delightful to the eye, neither will it wear. The work of the last twenty years in general, except so far as embodied in the ex-

tracts from Fischer, finds no place in it, though here and there an isolated fact is planted side by side with some crude observation of the first quarter of this century. Ihering's classification, the most pregnant and suggestive (if not the most successful) attempt in many years, is not even mentioned. There is shown no grasp of the subject; and, on contested questions of importance, the treatment recalls a man in a menagerie poking up the animals through the bars. Errors of fact and of the types could be cited in abundance: but it is not necessary to descend to small details; the real fault is with the architecture, not with the bricks.

THE PARIS METEORITES.

Guide dans la collection de météorites du Muséum d'histoire naturelle. Paris, *Masson*. 1882. 40 p. 8°.

THIS little work of some forty pages is valuable as giving in brief the results of the extended studies upon meteorites by Prof. A. Daubrée and his assistant Dr. Stanislas Meunier. Besides furnishing a catalogue of all the specimens to be found in the collection, three hundred and six in number, it discusses the origin, characters, classification, etc., of meteorites. These are regarded as having a common origin, and possessing types corresponding to rocks and structures of terrestrial origin, i.e., to lavas, dunite, lherzolite, serpentine, breccias, pumice, metallic veins, metamorphic rocks, etc. The classification is one which, in its simpler divisions, has been well received, but in the minor subdivisions is but little known; hence it is a matter of interest to place this classification in its latest phase before our readers.

METEORITE.

I. HOLOSIDERITE.
Octibbehite, tazewellite, nelsonite, catarinite, braunite, caillite, schwetzite, jewellite, campbellite, burlingtonite, tuczonite, lenartite.

II. SYSSIDERITE.
Pallasite, atacamaite, brahinite, deesite, lodranite.

III. SPORASIDERITE.
1. *Polysiderite.* — Toulite, logronite.
2. *Oligosiderite.* — Aumalite, chantonnite, aiglite, montrejite, parnallite, luceite, canellite, mesminite, belajite, butsurite, manbhoomite, banjite, limerickite, menite, bustite, richmondite, tieschite, erxlebenite, quincite, stawropolite, tadjerite, rutlamite, renazzite.
3. *Cryptosiderite.* — Howardite, ornansite, chladnite.

IV. ASIDERITE.
Igastite, rodite, eukrite, shalkite, chassignite, bokkevelite, orgueillite.

The principal divisions, as will be readily seen, are based on the presence or absence of iron, and its relations to the associated silicates when they are present. The subdivisions are named from the localities at which the specimen chosen as a type happened to fall. It is unfortunate that the bibliographical index, professing to give the principal works relating to meteorites, should be so very imperfect, — giving only *eight* works and papers, omitting such as the classical publications of Chladni in 1819, Schreibers, and Partsch, and the more recent ones of G. Rose, Shepard, Clark, Harris, Rammelsberg, Kesselmeyer, Phipson, Lawrence Smith, and others.

EARLY ORIENTAL HISTORY.

Histoire des anciens peuples de l'orient; par LOUIS MÉNARD. Paris, 1882. 468 p. 8°.

THIS work contains the outlines of Egyptian, of Assyrio-Babylonian, and of Israelitish history. Parts i. and ii. are profusely illustrated from the monuments. Part ii. (Assyria and Babylonia) covers 102 pages, and discusses in five chapters the region of the Tigris and Euphrates, the primitive times, the Sargonidae, the new Chaldean empire, the monuments, religion, manners, and customs. The author tells in a pleasing way what he knows of these topics; but, unfortunately, he is not a student of Assyriology, nor has he informed himself as to the latest results of Assyrian study. His authorities are the Old Testament, Berosus, and the classic writers and the older generation of explorers and decipherers (Botta, Layard, Rawlinson, Hincks). Of the younger generation, with one or two exceptions, he knows absolutely nothing (Smith and Sayce in England; Halévy, Pognon, and Guyard in France; Schrader, Delitzsch, and others in Germany). Hence he quotes (p. 261) from Berosus the Chaldean legend of the deluge, and points out its similarity to the biblical account, without even mentioning the cuneiform deluge story discovered by the lamented George Smith. On p. 262 he tells us that the name 'Babylon' seems to mean 'gate of god.' Certainly this meaning is above possible doubt. He informs us (pp. 262, 263) that the people of Accad and Sumer are of different race; the former being Cushites, and speaking a language approaching the Semitic tongue, the latter being of the Scythic or Turanian stock. He has evidently never heard of Paul Haupt, who has shown that the peoples of Sumer and Accad spoke the same language with dialectical differences, — a language utterly unlike any Semitic tongue. He says (p. 273) that 1112 B.C. is the oldest date which can be established for the history of Assyria. He should

have added, that, before this time, there is a long line of Assyrian kings, for many of whom the date can be fixed at least approximately. The author informs us that it has been supposed that the person kissing the foot of Shalmaneser on the black obelisk may be Jehu, king of Israel, whose name, he tells us, is mentioned in the inscription (p. 278). The Israelitish face of the kneeling figure, and the fact that the name Jehu (Assyr., *Ya-u-a mar Hu-um-ri-i* = Jehu the son of Omri) stands immediately above the picture, ought to allow of no doubt in the matter. The statement (p. 285) that Shalmaneser, the predecessor of Sargon, is not once mentioned in the cuneiform inscriptions, is incorrect; for he is named in the Eponym canon (III. R. 1. col. V. 1),[1] and at least one other time (cf. George Smith: The Assyrian canon, p. 84). The author gives the conflicting opinions of Lenormant and Maspéro, as to the fate of the rebellious brother of Assurbanipal (p. 301). Assurbanipal's own statement is explicit to the effect that his brother was burned, though the gods are represented as having performed the work (V. R. 4. 46 ff.). It is misleading to say (p. 275) that the Assyrian kings never tried to hold by mild government their conquered provinces; for the later kings at least often bestowed favors on captive princes, not seldom replacing them on the throne. Such cases of inaccuracy and uncertainty might be multiplied. The writer knows too little of recent work in Assyriology, and does not hesitate to express his scepticism as to the way in which Assyrian students read proper names (pp. 271, 301). One who has not studied the language for himself can, of course, not yet write a history of Assyria and Babylonia. The book has the credit of brevity, and gives very well a general impression, but cannot be relied upon in detail.

[1] R. is the usual way of representing the great collection of Assyrian texts called 'The cuneiform inscriptions of Western Asia,' of which Sir Henry Rawlinson is editor. The Roman numeral preceding indicates the volume; the following numerals refer to the page, column, and line.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

ASTRONOMY.

Transit of Venus observations at Helderberg, N.Y. — Mr. R. H. Tucker, jun., of the Dudley observatory, gave a detailed account of the arrangements for, and results of, his observation of the transit of Venus, at a station established for the purpose on the Helderberg table-land, about thirteen miles westward from the city of Albany. The site chosen was the U.S. coast and geodetic survey, and the N.Y. state survey station, Helderberg; lat. 42° 37′ 38″, long. 74° 00′ 39″; altitude, 1,823 feet. The cloudiness which prevented the observation of either contact at the Dudley observatory was but partial at the Helderberg station, and a satisfactory view of the second contact was realized. An estimate was also made of the time of the first contact, based upon a comparison of the phase first seen a few minutes later, with diagrams constructed in connection with preliminary practice.

The errors of the chronometers were obtained by heliotrope signals, and powder-flashes from the Dudley observatory, and by sextant observations of the sun. — (*Albany inst.; meeting* Jan. 2.) [80

Transit of Venus observations at New Haven. — Prof. H. A. Newton described his temporary mounting by which he used the eight-inch Grubb object-glass of the observatory to observe the contacts. Dr. L. Waldo referred to the preliminary drill with the Yale heliometer which the five observers and assistants with that instrument had undergone, and said that the results were extremely satisfactory. The definition was good most of the day, and the instrument and dome was manipulated quickly with no waste of time. He gave the following summary: 24 half sets of 4 pointings each, 10 whole sets of 8 pointings each, 20 single pointings on Venus for its diameter, 10 position measures at ingress, and 6 position measures at egress, with time observations of the four contacts. Mr. Willson described an arrangement by which he had put a cast-iron cylindrical plate-holder in the eye end of the Grubb telescope, and had projected a mercury horizontal surface, together with the reticule glass lines on each of the hundred and fifty or more photographs he had reason to think would develop well. He also described a ten-foot rod caliper he had used in measuring the plate distance from the object-glass. He used a simple crown lens of about one inch and a quarter aperture, and ten feet focal length.

Mr. Sherman, through the courtesy of the scientific school, used the nine-inch equatorial, and obtained about eighty-seven sets of transits of Venus and the sun's limbs across a system of inclined lines ruled on glass. Professors Van Vleck, Lyman, Wright, and Brewer took part in the discussion following the above papers; and, after describing their own contact observations, referred to the atmosphere of Venus, and in general regarded the want of intense blackness of Venus's disc as an effect of contrast with the sun. — (*Conn. acad. arts sc.; meeting* Dec. 20.) [81

MATHEMATICS.

Septic transformation. — Mr. Ely has obtained the modular equation for the septic transformation by a purely algebraical process. Aside from the result directly arrived at, the paper is valuable as affording a clew as to the (algebraical) methods of procedure to be followed in obtaining the odd prime transformations of higher orders. — (*Proc. Lond. math. soc.*, 1882.) T. C. [82

Transformation of elliptic functions. — This paper, by Professor Smith of Oxford, is too important for a brief abstract. On its completion, a proper review will be given of its contents. — (*Mess. math.*, 1882.) T. C. [83

Curves of any deficiency. — Mr. Buchheim ex-

tends the theory of Steiner's polygons and Prof. Sylvester's theory of derivation to the case of curves of order n and deficiency p in an $(n-p)$ flat. The extension involves the use of Abelian functions instead of elliptic functions, as in the case of a plane cubic, and is based principally upon Clifford's well-known paper, On the classification of loci. — (*Proc. Lond. math. soc.*, 1882.) T. C. [84

Fourier's functions. — M. Nicolas prefers to denote, by this title, the functions more commonly known as Bessel's or cylindric functions. The author studies principally the different modes of representation of these functions by definite integrals and series. A novelty is the introduction of a method of Euler's in finding the development in form of a series of the functions of the second kind. — (*Annales école norm.*, xi., *suppl.*, 1882.) T. C. [85

Geometry of n-dimensions. — The author, M. V. Schlegel, here extends certain well-known theorems of ordinary plane and three-dimensional space geometry to a space of any number of dimensions. The paper deals only with completely limited figures, regular and irregular. *A homogeneously limited figure* is defined: 1°, as one in which each summit meets the same number of edges, planes, solids, etc.; 2°, as one in following any edge of which we meet the same number of edges, planes, etc. Writing 'homogeneous' instead of 'limited homogeneously,' we see that all plane polygons are homogeneous, etc. The author uses the methods of Grassman, and extends to hyper-space theorems concerning the triangle, quadrilateral, tetrahedron, hexahedron, and octohedron. — (*Bull. soc. math. France*, x., 1882.) T. C. [86

Curves whose co-ordinates are elliptic functions. — R. von Lilienthal discusses two classes of spherical curves having the following properties: The constants in the expressions for the co-ordinates, with the exception of one (which, with the modulus, is arbitrary), can be so determined that the sought curve shall lie on a sphere. The length of an arc of the curve can be given as an elliptic integral of the first kind increased by the difference of two elliptic integrals of the third kind.

For the second group of curves, the arbitrary constant can be so determined that the integral giving the length of arc shall be an elliptic integral of the first kind. It is also shown that the curves of the second kind lie on algebraical cylinders. — (*Journ. reine angew. math.*, xciii., 1882.) T. C. [87

Applications of the theory of binary forms to elliptic functions. — The author, Faà de Bruno, expresses the elliptic functions by aid of the absolute invariant, and gives a very rapidly converging series for the computation of the complete elliptic integral of the first kind. — (*Amer. journ. math.*, 1882.) T. C. [88

Rotation of a solid body. — This treats the case of rotation of a solid body about a point which is in general neither the centre of gravity of the body nor (in the case of a body of revolution) a point on the axis of revolution. The author, W. Hess of Munich, discusses the general case, and obtains several interesting theorems on making particular hypotheses as to the position of the point about which the body rotates. — (*Math. annalen*, xx., 1882.) T. C. [89

Vibrations of an elastic sphere. — Prof. H. Lamb here discusses the problem of the vibrations of an elastic solid whose dimensions are all finite. He has given several numerical calculations and diagrams, illustrating, in special cases, the results arrived at by the purely mathematical investigation. The author points out that the results of his analysis differ from the views advanced by Lamé (Théorie de l'élasticité) as to the nature of the fundamental modes of vibration of elastic solids in general; and indicates the error in Lamé's reasoning as consisting in the tacit assumption that a wave undergoes no change of character on reflection at the bounding surface of a solid, — an assumption the incorrectness of which was previously shown by Green. — (*Proc. Lond. math. soc.*, 1882.) T. C. [90

Subinvariants. — An important paper by Professor Sylvester, of which, since it is not yet completed, a review will be given at a later date. — (*Amer. journ. math.*, v., 1882.) T. C. [91

PHYSICS.

Apparent attractions and repulsions of small floating bodies. — The need of a thoroughly sound and at the same time simple popular explanation of capillary phenomena will probably make every teacher of elementary physics take up Prof. Leconte's article with interest. As he states, ordinary treatises are somewhat unsatisfactory upon this subject, even when they are not actually wrong. For instance, the in general excellent treatment of capillary action in Everett's 'Deschanel' handles the phenomena observed in a vacuum in a very gingerly manner, hinting at a certain mysterious pressure in the interior of liquids due to molecular action at the surface, even when such surface is plane, in order to account for the rise of liquids in fine tubes in a vacuum.

In view of the fact that the capillary action of liquids is practically the same in a vacuum as in air, Prof. Leconte appears to be of the opinion that it is unnecessary to take account of atmospheric pressure in explaining any of these phenomena. He proposes to base his explanation upon two 'fundamental principles:' 1. "That in every case, whether of moistened or non-moistened bodies, there exists an adhesion between the solid and the liquid." 2. "That the capillary forces are, in any given case, inversely proportional to the radii of curvature of the meniscuses, and their resultants, directed toward the centres of concavity."

We suppose Prof. Leconte will admit, however, that although the visible phenomenon of water sustained in a capillary tube, for instance, may remain unchanged when the surface of the water is relieved of the pressure of the atmosphere, the actual condition of water in the tube and of the film at the top of the column is somewhat changed. Thus Young says in his memoir on the 'Cohesion of fluids,' "when the surface is concave, the tension is employed in counteracting the pressure of the atmosphere, or, where the atmosphere is excluded, the equivalent pressure arising from the weight of the particles suspended from it by means of their cohesion," etc. In fact, it would seem the better plan in explaining the above phenomenon, to make full use of the unquestionable agency of the atmospheric pressure, so long as the atmosphere is present, and be thankful for it, since it is far easier to understand than the sustaining by cohesion that must take its place in a vacuum.

Prof. Leconte's statement of his second principle is a little puzzling; for a natural interpretation of his words would be, that he supposes the *surface tension* to be inversely proportional to the radius of curvature of the film. He applies his two principles to the explanation of three typical cases of attraction and repulsion. In the case of two moistened bodies he says, "But when brought so near that their meniscuses join each other, the radius of curvature of the united intervening concave meniscus . . . is less than that of the exterior concave meniscuses, . . .

and its superior tension acts upon both bodies toward a common centre of concavity."

We do not think physicists generally will admit that a liquid film tends to draw a solid, to which it is attached toward the centre of concavity of the film. Indeed, if this were so, the tendency of a column of water raised between two floating bodies by surface tension would be to lift those bodies: similarly a column of liquid sustained in a fine tube would tend to lift the tube. This action, however, is denied both by theory and experiment. In fact, unless we have misunderstood Prof. Leconte's language and diagrams, his article will not do all that it was intended to do, toward removing the difficulties in the way of a student beginning the study of capillary phenomena. — (*Amer. journ. sc.*, Dec., 1882.) E. H. H. [92

Rigidity of the earth. — G. H. Darwin discusses the long-period tides — the lunar fortnightly declinational and the lunar monthly elliptic — from 33 years' observations in England, France, and India, and finds that they are reduced to 0.7 of their theoretic height. There should be no reduction on a rigid earth, and no ocean tides on a liquid earth: as the actual effect of the earth's yielding to the moon's attraction is only 0.3 of the difference between these extreme effects, the earth is considered at least as rigid as steel. — (*Nature*, Nov. 2, 1882.) W. M. D. [93

Optics.

Molecular refraction. — In an investigation on the refractive powers of carbonic ether and its sulphur substitution products, E. Wiedemann finds that the atomic refraction of sulphur depends upon its place in the molecule as does that of oxygen. — (*Wied. ann.*, Dec., 1882.) C. S. H. [94

Dispersion formulas. — A. Wüllner shows that in a large number of colorless substances, in which case the absorption constant may be regarded as zero, two of the constants in Helmholtz' dispersion formula are sensibly equal, and the formula reduces to one of two constants, which is then equivalent to that of Lommel. The same was found to hold true of an alcoholic solution of alizarine, as also of an aqueous solution of amonio-sulphate of copper. — (*Wied. ann.*, Dec., 1882.) C. S. H. [95

Diffraction. — A series for the calculation of Fresnel's integrals, and a table of values, are given by A. Lindstedt. — (*Wied. ann.*, Dec., 1882.) C. S. H. [96

(*Photometry.*)

Photometric observations of the transit of Venus. — Professor E. C. Pickering has made some comparisons of the brilliancy of the sun, of Venus, and of the region in the immediate vicinity of the limb of the sun, whereby the photometric illumination of that portion of the corona may be determined. An ordinary double-image-prism photometer with a few slight modifications, attached to the tail-piece of the 15-inch equatorial, was employed for the observations. Calling the light of the sun 100, the mean of thirty-two settings taken between 1 h. 07 min., and 1 h. 30 min., Cambridge mean time, gave: Venus 1.8, and the sky 8.8. The mean of twenty-four settings taken between 2 h. 48 min. and 2 h. 54 min. gave: Venus 1.4, and the sky 6.2. The mean of all gave: Venus 1.6, and the sky 7.5 or 4.7 times as bright as Venus. [According to this, the light of this portion of the corona would seem to be about 3.7 times as brilliant as the light reflected by that portion of our atmosphere lying between us and the sun.] — W. H. P. [97

Heat.

Thermal conductivity of rocks. — A novel method has been employed by M. Thoulet for the determination of the thermal conductivity of minerals and rocks. Instead of measuring the temperatures at different distances from the source of heat, measurements are taken of the time required for the passage of a certain quantity of heat through a section of known thickness. The 'thermal resistance' is defined as the time required for the passage of a definite quantity from a source at 100° C. through a thickness of 0.01 mm. The thermal resistance is consequently inversely proportional to the thermal conductivity. Glass and iron have already been experimented on, and the method appears to give very accurate results. — (*Ann. chim. phys.*, (5). xxvi. 261.) C. B. P. [98

Heat of combination a function of atomic weight. — Mr. Laurie shows, that if the atomic weights of elements are taken as abscissae, and their atomic heats of combination with chlorine, bromine, or iodine, as ordinates of a curve, the heats of combination will be seen to be a periodic function of the atomic weights. — (*Phil. mag.*, Jan., 1883.) C. B. P. [99

Electricity.

Electrical resistance of selenium cells. — In a communication to the Physical society of London in June, 1881, Dr. James Moser urged that the decrease in electrical resistance observed in a 'selenium cell' when acted upon by a beam of light, is due to heating, which by expanding the selenium makes it press more firmly against the metallic electrodes of the cell, thus establishing better connection. The fact that luminous are more effective than obscure rays in producing the observed change, Dr. Moser sought to explain as a result of selective absorption. Mr. Shelford Bidwell undertook to put Dr. Moser's theory to the proof by heating selenium cells to known temperatures in the dark, and observing the consequent change in electrical resistance. It appears from his experiments, that below a certain temperature, which is different for each cell, heating increases the electrical resistance of the cell; that above this temperature heating decreases the resistance, the temperature of maximum resistance being usually somewhat above ordinary temperature, but in one case being 13° C. Mr. Bidwell concludes, however, that the action of the luminous rays upon the cell cannot be explained by their heating effect alone; for he finds that whereas a moment's exposure to direct sunlight, though causing a great fall of electrical resistance, yet heats the selenium to a hardly perceptible extent, an equal decrease of resistance caused by heating in the dark could be produced only by making the cell too hot to handle. Mr. Bidwell concludes from his experiments that the action of the *carbon* photophone is to be explained by the heating alone. — (*Phil. mag.*, Jan., 1883.) E. H. H. [100

ENGINEERING.

Practical test of the safety of bridges. — It is well known among engineers, that, with good iron properly used, our bridges may be relied upon for an indefinite length of service. The best practice never loads a structure with more than from one-fourth to one-sixth of the weight that would break it down. Any load put upon a piece of iron will stretch it to a slight extent. Upon removing the load, the iron should regain its original form. This it will do if it has not been overstrained. A very simple and effective piece of mechanism has been for some time in use at the East-River suspension-bridge at Brooklyn for determining the precise effect of any load upon any part of the structure. A bar ten or twelve feet long is attached to any member of the bridge in such a manner that any increase in the length of such

member is at once imparted to the standard bar, and is so multiplied by delicate mechanism as to become plainly visible. In testing a bridge, a movable index upon the standard bar is first placed at zero. A load is then run on to the bridge, when the index moves on account of the stretch imparted by the bridge to the standard bar. The weight is now removed from the bridge, when the index returns to zero unless the iron has received a permanent elongation from the load — that is, unless the iron has been overstrained. Not only does this method enable us to determine whether a bridge is safe for the time being; but we can also answer the not less important question, whether the bridge is holding its vitality through long periods of time. The above apparatus is so delicate as to indicate a strain on the iron less than a thousandth part of the weight that would break it. By means of this device, not only do we substitute exact measurement for mere opinion, but we are enabled to answer a good many vexed questions in regard to the precise condition of complex structures of iron. G. L. V. [101

Cable power for street-railways. — There is probably no more abused piece of motive power than the horse which draws our street-cars. Leaving out of view the outrageous cruelty to which these unfortunate animals are often subjected, it may well be questioned whether such power is in any way economical. Whether steam or electricity will soon be employed upon street railways, may be questioned; but there is reason to think that the so-called cable system may furnish a solution to many of the problems in city transportation. There is nothing new in the idea of a continually moving, endless wire cable beneath the roadway, to which cars may be attached at any point; but to reduce the idea to practice involves a good deal of mechanical skill and a very considerable expense. Mr. J. D. Miller gives a description of the Chicago cable roads, in which he states, that, in October last, there were in Chicago over four miles of cable roads in operation, — an amount which has been largely increased since that time. The first cost of these roads is reckoned to be not less than $100,000 a mile for a double track. The cost of operation is said to be much less than by the common method, the percentage of saving being greater as the traffic becomes larger. — (*Journ. assoc. eng. soc.*, Oct.) G. L. V. [102

Tests of building materials. — An important series of experiments upon the strength of timber has been for some time past carried on by Professor Gaetano Lanza at the institute of technology in Boston, and also at the Watertown arsenal. The experiments from which the data in our books have been determined were in nearly all cases made upon very small and very carefully selected pieces of well-seasoned wood. From the data thus obtained we have assumed that we could at once pass to the more or less defective and generally quite unseasoned timber which is employed in actual work. This method has often led to most absurd and unreliable results, and has been a fruitful source of that discordance which so often appears between science and practice. Instead of small wooden beams an inch square and two or three feet long, Professor Lanza uses beams twenty feet long and of the common sizes used in building; and, instead of the perfectly clear and well-seasoned material employed by the older experimenters, he takes his beams just as they come from the lumber-yard. In fine, the experiments now being carried on are as far as possible under the real conditions of practice, and not under the imaginary conditions of the closet. The result of these experiments will put into the hands of the engineer far better data for fixing the dimensions of the important structures on which our lives depend than we have before possessed. — G. L. V. [103

CHEMISTRY.

Reproduction of the osmides of iridium. — By heating iridium with iron pyrites, M. Debray obtained it in octahedrons of the regular system, which were removed from the sulphide by dissolving out the latter with hydrochloric acid. Mixtures of iridium and osmium treated in a similar manner gave regular octahedrons which resembled in all respects the natural osmides. The natural osmides are thus shown to be isomorphous mixtures, crystallizing probably in the regular system. — (*Comptes rendus*, xcv., 879.) C. F. M. [104

Thorite and the equivalent of thorium. — In a variety of thorite recently discovered at Arendal in Norway, L. F. Nilson finds a large percentage of iron, lead, and uranium, the latter in the form of dioxide. To separate thorium from cerium oxide, after precipitating the oxalates they were converted into sulphates, and advantage was taken of the slight solubility of hydrous thorium sulphate at 0°. In determining the atomic weight of thorium, the purified sulphate $Th(So_4)_2 . 9H_2O$ was ignited at first gently to expel the crystal water, then to a glowing white heat until the acid was driven off. As a mean of ten determinations calculated from the residue ThO_2, the value 235.43 was obtained. The metal was prepared in nearly the theoretical quantity by igniting potassium thorium chloride mixed with a few grms. of salt, and covered with sodium in a tube filled with salt. When heated in a current of chlorine gas, the metal is converted into the chloride. It unites readily with bromine and iodine, and is easily soluble in acids. Under no conditions does it decompose water, nor is it attacked by alkaline hydrates. — (*Berichte deutsch. chem. gesellsch.*, xv., 2519.) C. F. M. [105

Modification of the law of isomorphism. — An examination of the isomorphous metatungstates and tungstoborates, by D. Klein, led to results which could not be explained by the law of Mitscherlich. A better interpretation was found in a modification of the latter part of this law, first proposed by M. de Marignac. "Isomorphous bodies either have a similar chemical composition, or they consist *chiefly* of the same group of elements or of groups with identical chemical functions." — (*Comptes rendus*, xcv., 781.) C. F. M. [106

Electrolysis of hydrochloric acid. — In the electrolysis of hydrochloric acid, using platinum electrodes, D. Tommasi finds that the heat absorbed in decomposing two molecules of the acid amounts to 78.6 cal. Since platinum chloride was found in solution, a certain quantity of the electromotive force (not determined) must have been absorbed in its formation. One Daniell's cell (E = 49 cal.) with one zinc-cadmium element (E = 16.6) decomposed the acid, but no chlorine appeared at the positive pole. With two Daniell's cells, bubbles of an oxide of chlorine were observed. When dilute hydrochloric acid (1 conc. acid : 20 H_2O) was subjected to electrolytic action, the liquid at the positive pole became yellow and exerted a strong bleaching action. M. Tommasi regards this action as due to the formation of hypochlorous acid which attacks the electrode in the concentrated acid solution. — (*Comptes rendus*, xcv., 689). C. F. M. [107

Changes of volume and of molecular arrangement in hydrous salts. — An unequal expansion of the alums when heated led E. Wiedermann to con-

clude that a molecular re-arrangement (*umlagerung*) takes place below 70°. Different volumes of the salt Mg. SO_4 6 H_2O at 93° and 50° point to a new modification at 93° since Marignac determined its composition at 50°. The salt Zr SO_4. 6 H_2O also shows a difference in volume at 40° and 69°. — (*Ann. phys. chem.*, n.f., xvii., 561.) C. F. M. [108

METALLURGY.

A great feat in metal-working. — Messrs. Kloman rolled a steel strip 6 in. wide, ¼ in. thick, and 310 ft. long, at their mill at Allegheny. They have contracted with the U. S. spring car motor construction company for an unlimited number of these steel springs. This company had previously applied to all the large English and continental works, and to other American works, without finding any one ready to undertake the work. — (*Iron*, Nov. 17, 1882.) R. H. R. [109

Molecular condition of metals. — Kalisher has found that sheets of most metals may be rendered crystalline by heat. A zinc sheet will become crystalline at 307° F. : tin and cadmium at 392° to 536°. Most metals obtained by electro-metallurgy give the same result. — (*Iron*, Dec. 8, 1882.) R. H. R. [110

Steel-iron. — M. Keil has succeeded in producing a welded metal which is stated to possess the characters of both iron and steel. It is prepared by pouring the fluid steel on one side of a partition in a mould, and fluid wrought iron on the other: the partition is made of such thickness that it will weld by the heat of the added fluids. This so-called steel-iron is said to have been prepared in five ways : 1°, steel by the side of iron; 2°, steel between two layers of iron; 3°, iron between two layers of steel; 4°, a core of steel surrounded by iron; 5°, a core of iron surrounded by steel. — (*Iron*, Dec. 15, 1882.) R. H. R. [111

Compression of metals. — An improved method of treating all kinds of metals and alloys has been patented by Mr. Louis Clemandot of Paris; it consists in subjecting them, when raised to a temperature sufficiently high to insure the necessary ductility, to powerful compression, and then allowing them to become completely cool while still under pressure. An increased density and hardness is claimed for metals thus treated. — (*Min. and sc. press*, Nov. 18, 1882.) R. H. R. [112

MINERALOGY.

Axinite. — Crystals of this mineral from near Bethlehem, Penn., have been studied by B. W. Frazier. He endeavors to show the resemblance in crystalline form between this mineral and datolite. Placing the crystals in position so that the zone *p*, *l*, and *u* shall be parallel to the vertical, *p*, *m*, and *r* to the macrodiagonal, and *y*, *m*, and *b* to the brachydiagonal axes, the following relations are obtained from v. Rath's measurements : —

$\breve{b} \wedge \breve{c} = \alpha = 81° 56' 59''$	$O \wedge \breve{u} = A = 82° 09' 48''$
$\breve{a} \wedge \breve{c} = \beta = 91° 51' 28''$	$O \wedge \breve{u} = B = 90° 04' 21''$
$\breve{a} \wedge \breve{b} = \gamma = 102° 52' 14''$	$\breve{u} \wedge \breve{u} = C = 102° 44' 18''$

$$\breve{a} : \breve{b} : \breve{c} = 1 : 1.56903 : 0.48742$$

The corresponding for datolite are

$$\beta = 90° 06' \qquad O \wedge \breve{u} = B = 90° 06'$$

$$\breve{a} : \breve{b} : \breve{c} = 1 : 1.5712 : 0.49695$$

Besides the relation in axial lengths and angle β, a still closer relation is shown in the angles between corresponding planes. The author also calls attention to the similarity in crystalline form between datolite and calamine, — the latter having the axial relation, $\breve{a} : \breve{b} : c = 1 : 1.5564 : 0.47657$, — and their similarity in composition, datolite being H B Ca $Si O_5$, calamine $H_2 Zn_2 Si O_5$. He can, however, show no relation between their composition and that of axinite. — (*Amer. journ. sc.*, Dec., 1882.) S. L. P. [113

Saussurit. — By means of microscopical investigation, A. Cathrein has shown that this mineral is composed of numerous microlites of zoisite in a ground mass of feldspar. He also shows, by calculation from various analyses and optical examination, that the mineral has been derived from plagioclase, more seldom orthoclase, by a loss of silica and alkalies, and taking-up of lime, iron, and water; and that thereby the minerals zoisite and epidote have been formed, giving rise to the microlites, which with the remnant of feldspar make up the mass. — (*Zeitschr. kryst.*, vii. 243.) S. L. P. [114

Danburite. — This interesting mineral, of which such beautiful examples have been described by Professors Brush and Dana from St. Lawrence County, N.Y., has been lately discovered at Scopi, in Canton Graubünden, Switzerland, and fully identified and described by C. Hintze. The crystals occur in prisms 2–15 mm. long, ½–3 mm. broad; are colorless to wine-yellow, and brilliant. The author gives the results of crystallographic measurements, which agree very closely with those obtained from the American crystals with some additional new planes. In habit the crystals vary much from the American. As terminal planes, the pyramid (1 4 2), often occurring alone, and macrodome (1 0 1) are most frequent. The base, which never fails on the American crystals, was but once observed, and then as a doubtful crystal plane. The prismatic zone appears very much striped. On account of the abnormal size of one of the dome-planes or two adjacent pyramidal planes, the crystals often have a decided monoclinic appearance. The optical properties coincide with those of the American variety. — (*Zeitschr. kryst.*, vii. 296.)

The above mineral has been analyzed independently by C. Bodewig and A. Schrauf, giving results which are wholly in accordance with the analyses of the American mineral. C. Bodewig's analysis gave $Si O_2$ 48.66, Ca O 22.90, $B_2 O_3$ 28.09, $Fe_2 O_3$ 0.23, $Al_2 O_3$ 0.08 = 99.96. — (*Zeitschr. kryst.*, vii. 391.) S. L. P. [115

GEOLOGY.

Lithology.

The trachytic rocks of Tokay, Hungary. — Professor Szabó gives in this paper the outlines of his new classification of trachytic rocks, the term trachyte covering for him about as extended a range as the term 'greenstone' used to do. His divisions are as follows : —

A. Trachyte without biotite.

I. *Augite-trachyte;* with anorthite-bytownite, without biotite or quartz. Olivine very rarely found.

II. *Amphibole-trachyte;* with labradorite-bytownite, augite rarely entirely absent. Quartz wanting.

B. Trachyte with biotite.

III. *Micaceous-amphibole-trachyte;* with andesite-labradorite; with or without quartz, augite, and garnet.

IV. *Micaceous-amphibole-trachyte;* with oligoclase-andesite, with or without quartz and augite.

V. *Micaceous trachyte;* with orthoclase-oligoclase, with or without quartz and amphibole. Augite rarely absent.

The micaceous trachytes are regarded as older than

the others. The paper contains a discussion of the geological relations of the trachytes in general.

The Tokay rocks are the following: 1. Augite-trachyte. 2. Amphibole-trachyte. 3. Micaceous-quartz-trachyte. 4. Conglomerates and trachytic tufas. 5. Red plastic clay. 6. Prehistoric and recent alluvium.

The microscopic, chemical, and geological characters of the rocks are given, with a discussion of their former nomenclature. — (*Assoc. franç. avanc. sc.*, x. 532.)

In this connection attention may be drawn to two other papers by the same author, relating to the classification of the trachytes: Classification macrographique des trachytes (*Bull. soc. géol. France*, Dec. 7, 1881); and Die makrographische eintheilung der trachyte. — (*Verhandl. k.-k. geol. reichsanst.*, 1882, 166.) M. E. W. [116

A new basaltic rock. — The name pyroxenite is given by Dr. C. Dölter to a rock from the Cape Verde Islands, composed of augite, magnetite, and a glassy base. — (*Verhandl. k.-k. geol. reichsanst.*, 1882, 140.) M. E. W. [117

METEOROLOGY.

Ohio state weather service. — This service, recently organized, has begun the publication of monthly reports. The November issue contains returns from nineteen stations, including five maintained by the U. S. Signal Service, accompanied by a well-arranged monthly summary. — W. U. [118

Observations at high stations. — The Austrian meteorological service established in 1880 self-recording instruments at Klagenfurt and Obirgipfel, stations situated near each other geographically, but having altitudes of 438 and 2,044 met. respectively. Hourly observations to the end of the year 1881 have been recently published, embracing those of pressure at both stations and of temperature at Klagenfurt only. — (*Jahrb. k.-k. centr. anst. meteor.*, 1882.) W. U. [119

Rainfall statistics. — Systematic observations of rainfall throughout France are made by the Bureau central meteorologique. The results for 1880, deduced from 1,291 stations, have been collected and studied by M. Th. Moureaux, who publishes twenty-five charts in illustration: eight of these are designed to exhibit the connection between rainfall and barometric depressions, and confirm the opinion advanced by Prof. Loomis from his studies of the U. S. weather-maps, that rain is most abundant in advance of a depression, and that therefore the direction in which a storm will move can be foretold by the distribution of the rain areas. (*Sur le régime des pluies en France pendant l'année* 1880.) Mr. Symons, through whose efforts more than 2,000 stations in Great Britain have been established, has published valuable suggestions for securing uniformity of practice among rainfall observers. — (*Symons' meteor. mag.*, Dec., 1882.) W. U. [120

Floods in France. — Camille Flammarion describes the year ending with November, 1882, as one of very numerous rainy days, although of normal rainfall, in France. In Paris the rainfall at the Montsouris observatory was 543 mm., closely agreeing with the average of other years: but the number of rainy days was 208, and besides these, 100 more were cloudy. As a result, summer evaporation, which ordinarily disposes of much of the rainfall, was this year very ineffective; the ground became saturated, and when the November rains (113 mm.) came, the rivers rose rapidly throughout the country. — (*Le Voltaire*, Paris, Dec., 1882.)

Th. Moureaux gives further account of the rising of the Seine early in December. — (*La Nature*, Dec. 23, 1882.) W. M. D. [121

Auroras. — An extensive catalogue of auroras observed in Sweden from 1800 to 1877 has been published by R. Rubenson, director of the meteorological institution of Sweden. It forms the second part of the catalogue of auroras observed since the sixteenth century. The appendix contains descriptions of the auroras, and tables of the annual variation in frequency, and the years of maxima and minima. — (*Cat. aurores bor. observ. en Suède, 16th cent.* — 1877, part 2.)

Mr. J. Rand Capron calls attention to the fact, that the auroral display in November was followed by first a cold and then a warm wave. The doubt raised as to the character of the supposed auroral beam, which was observed in England, and from which the height of the aurora has been calculated, is removed by the statement that it gave the auroral spectrum. — *Nature*, Dec. 28, 1882.) W. U. [122

GEOGRAPHY.

(*Arctic.*)

Theory of an open polar sea. — Mr. George R. Howell, of the New-York state library, read a paper favoring this theory. He remarked that the field of new exploration is rapidly narrowing to that of the north polar region. Among the reasons for the open-sea theory are: —

1°. Water-fowl go regularly each spring northward from Greenland for nesting. As the ice-barrier from 73° to 82° is too cold for birds to raise their young, their nesting-places must be north of this barrier, and in a milder climate. 2°. The occurrence of warm winds from the circumpolar regions, as verified by explorers in high latitudes. 3°. The occurrence of furious gales during the long arctic winter, which would be unaccountable if the region for ten degrees around the pole were as cold as the zone of the ice-barrier, and therefore as calm as the equatorial belt. 4°. Morton and Hayes both saw open water in Kennedy channel as far as the eye could reach northward.

Mr. Howell spoke of the agency of the gulf stream, which is commonly regarded as limited to the latitude of Spitzbergen. His own belief and theory is, that the waters of the gulf stream have a greater specific gravity than those surrounding the ice-barrier, for two reasons: first, the immense rain and snow fall of the arctic regions must freshen the water and make it lighter; and, second, water is lightest near the freezing-point. The comparatively warm water of the gulf stream dips and passes northward under the ice-barrier, and emerges, with velocity reduced by corresponding currents from the opposite side of the pole, into the comparatively warm polar sea. The same cause would produce an ascending current of warm air, to exert a marked influence upon the atmospheric currents of the whole northern hemisphere. Such in brief is the normal system of water and air currents, according to the theory of the speaker, whose paper was listened to with special interest. — (*Albany inst.; meeting* Jan. 16.) [123

Sea-otter hunting. — The sea-otter hunting in the Kurile Islands, now Japanese territory, has been chiefly farmed out to foreigners as a government monopoly. It is now proposed to form a Japanese company for the purpose of carrying on the business on a larger scale than hitherto. The pelts of Enhydra marina are the most valuable furs known, and the animal is found only in the Kuriles and Alaska in any numbers. — W. H. D. [124

British co-operation in arctic meteorological and magnetic research. — Letters have recently been received from Capt. H. P. Dawson, R.A., who has been appointed to undertake the work of establishing one of the chain of circumpolar observing stations in the scheme of the international commission, originally suggested by the late Lieut. C. Weyprecht. During the past summer Capt. Dawson, with two observers and an artificer, started for the Hudson Bay Territory with the idea of establishing a station at Fort Rae or Fort Providence on Great Slave Lake. Funds for the expedition to the amount of $12,500 were guaranteed by the government, $5,000 by the Royal society, and the Canadian government has since added the sum of $4,000. It is supposed that this will suffice to keep the party in the field for at least two seasons. When last heard from, all were well, though somewhat late in reaching their destination. It was not certain at last accounts whether one of the posts above mentioned, or old Fort Simpson, would be decided upon; the last-mentioned offering several advantages not shared by the others, though on some accounts less desirable. — W. H. D. [125

(*South America.*)

Early exploration of the Amazon. — The reprint of P. Texeira's voyage up the Amazon (1637–1638) is continued. — (*Bol. soc. geogr. Madrid*, xiii., 1882, 266–275.) W. M. D. [126

Bolivian table-land. — The plateau southward from Lake Titicaca was explored and surveyed during a part of 1882, by J. B. Minchin, for the Bolivian government. Its altitude is 12,000 or 13,000 feet, with generally level surface, broken by isolated hills and smaller ranges. On the east, the Cordillera Real, or main chain of the Andes, is composed chiefly of stratified rocks, rising to great heights, and culminating in Sorata and Illimani. On the west, the Coast Range is largely volcanic, with some vents still active. Both ranges are metalliferous. The eastern range has copious rains and an ample plant-growth; the western is dryer and almost barren. The Desaguadero, or outlet of Lake Titicaca, flows along the eastern side of the plateau, over low, flat land, very boggy in the wet season, into Lake Poöpó or Aullagas, about 50 by 15 miles, but with low banks and variable area. From its south-western angle an outlet, the Laca-Ahuira, carries off what is not lost by evaporation. This stream flows underground for three miles of its course, and farther west is lost in the Salinas de Coipasa, which receives several other rivers, some fresh (Llauca, Isluga), some brackish (Sabaya, Cariquima): these salinas are about 400 square miles in area, and of dazzling white surface. A little to the south-east begin the great Salinas de Garcimendoza, with an area of 4,000 square miles, a white and perfectly level sheet of salt, three or four feet thick; in the dry season it can be crossed on horseback. The former area of the lake from which these salinas remain is estimated at 20,000 square miles; its old shore-line is marked by a persistent level calcareous incrustation, 200 feet above Lake Poöpó. — (*Proc. geogr. soc. Lond.*, Nov., 1882, map.) W. M. D. [127

(*Europe.*)

Southern Russia. — J. Garnier gives an interesting account of the region about the river Donetz, visited at the end of 1881. Rocks of the coal-measures give a gentle relief to the surface, the greatest difference found between valley and hilltop being only 150 met.; but the surrounding country is more even, a part of the great plain extending to the Arctic Ocean. The climate is consequently variable; very cold and snowy in the winter season, which begins in October. The rivers and the Sea of Azoff are frozen about four months. A quick change gives warm weather in May, and a fresh vegetation springs up; but the summers are so dry and hot that the harvests often fail. Irrigation cannot be practised, as the streams run in valleys 40 or 50 met. below the general surface. Roads are very bad, except when smoothed over with snow. The peasants pitied the French people who had some winters without snow! Towns are few, and the population is so sparse that the fields are often cultivated only once in three years. Trees are absent, except occasionally on the river-bottoms, and wood is too dear to be used for fuel. The absence of forests is the result, according to Le Play, of the severe climate; Hommaire de Hell says tree-roots cannot penetrate the compact soil; the Cossacks themselves believe the trees have been cut away and not replanted. In spite of many unfavorable conditions, years of good harvest yield immense quantities of grain for exportation. Coal forms an undeveloped resource of the country. It was discovered in the time of Peter the Great, and has lately been studied under the direction of Helmersen; but in spite of its great quantity and excellent quality, it was hardly worked till after the Crimean war; then the better steam navigation of the Black Sea, and the beginning of railroad construction in Southern Russia, gave a new impulse to mining, and in 1881 1,600,000 tons were raised. Still English coal is found in all the ports of the Black Sea. This is largely because the coal from the Donetz mines has no good harbor for export, for the Sea of Azoff is but 4 met. deep at its entrance, the Strait of Kertch; and at Taganrog, its most important port, now connected by rail with the mines, vessels drawing only 3.5 or 4 met. must anchor 25 kil. from the shore, and load or discharge by double transfer to cart and lighter. Although possible with wheat, this is too expensive for coal. The harbors might be much improved by dredging. — (*Bull. soc. géogr. Paris*, 1882, 498.) W. M. D. [128

(*Asia.*)

Across Eastern Gobi. — Hermann Mandl, a young German, who went to try his fortunes in the East, spent two years learning Chinese at Peking, and was then engaged, in 1880, as interpreter by Gen. Zo-zung-tang, who was about to lead an army across the desert to Hami in view of possible difficulty with Russia concerning the occupation of Kuldja. Lieut. G. Kreitner, who had been as far as Ansifan two years before, gives a sketch-map and account of Mandl's expedition from Ansifan across Gobi to Hami, and compares it with the description of the same region in 1875 by Major Sosnowski (*Journ. roy. geogr. soc. Lond.*, 1877, 166). Ansifan is in 95° 56′ 50″ long. E. of Gr., and 40° 31½′ N. lat., at an elevation of 1,144 met., on a fertile plain watered by the Sula-ho, which rises in the snowy Nan-san on the south, and flows westward into the desert, ending in the reported Kara-nor. The city suffered greatly in the rebellion of 1868, as did many neighboring towns, and has now only a thousand inhabitants, many of its houses being empty. Kua-Tchou, some twenty miles west-south-west, was at this time completely destroyed, though it still appears on most maps as an important place. On the 26th of July, 1880, Mandl left Ansifan. His party travelled at night to avoid the excessive heat, — the thermometer had registered 107° F. before starting, — and was eleven days on the way, averaging fifty miles to a march. The loose sand of the flat desert, and the rough stony paths over the occasional hills, which sometimes rise 120 feet above the plain, made travelling extremely dif-

ficult; the resting-stations were miserable places, often supplied with bad water from their springs. A few antelope were seen on the way.

Zo-zung-tang's army consisted of 2,500 men, who crossed the desert in divisions of 500 so as not to exhaust the water-supply on the way: they had not been paid for ten months, and their plundering made their advance like an enemy's invasion. But at Hami the people rejoiced at the coming of the holy general, for since his arrival it rained as it had not for a long time before. Moreover, he had posted orders that all brawlers and opium-dealers should be beheaded, all impostors should be punished with 3,000 lashes and should then have their ears bored with a lance, and he advised the people to let the soldiers have nothing till they had paid for it. Hami lies at the southern foot of the eastern extension of the Tian-san, at an elevation of 960 met., with a broad, well-watered pasture-land stretching thirty miles before it to the desert. Its population is 1,500–1,800 (Sosnowski said 10,000) besides a garrison of 3,000. [On Stieler's Atlas, sheet 64, 1881, *Ansifan* is given as *Ngansi Fan tcheu*, and is placed in latitude 39° 40′, or more than 50 miles too far south according to these data.] — (*Peterm. mitth.*, 1882, 416, map.)

W. M. D. [129

Russo-Persian boundary and Merv. — F. v. Stein gives a map and description of the most recent work on the region stretching eastward from the southern end of the Caspian toward the oasis of Merv. A railroad was completed in 1881 from Michailow on the Caspian, south-easterly to Kysyl-Arvat (about 130 miles); and it is now proposed to extend this along the inhabited strip of land between the Kopet Mountains and the Kara Kum (desert) to Askhabad, and perhaps to Seraks on the Tedjend (Heri-Rud river). With this object the Russian engineer Lessar has examined the route, and finds it one of very easy grades and construction, for the transition country between mountain and desert is very flat throughout. Levelling showed a depression below the level of the Caspian, about midway on the present railroad; and this is suspected to continue eastward, in which case the Tedjend and Murgab could not in former times have reached the old course of the Oxus, but must after their junction have flowed to the Caspian independently: now they are both lost in the sands of the Kara Kum. The people along the surveyed line gladly accept the present Russian and Persian government of their country, as a guard against the robbing Tekke tribes. The forts or walled towns contain a single street for the bazaars; from this, crooked, narrow, dirty alleys, often shut apart by doors, lead among the mud-huts, the only kind of habitation. In the fields at a distance from the forts, are scattered watch-towers with entrances so small that one must creep through them: the laborers hid themselves in these, blocking up the doorway, on the first appearance of a band of Tekke robbers, and there waiting till they had passed by. In the present better times, the towers are not needed. The former population must have been much larger than the present, for ruins are numerous; but the people have no traditions about their builders. Fields are cultivated only where irrigated; and on the larger rivers, Tedjend and Murgab, dams are constructed to feed numerous branching canals. The districts thus cared for have been much reduced in area in consequence of the plundering of the Tekke bands: the people have been driven off, and the canals are fallen into decay. [The question of the less supply of water is not considered.]

The oasis of Merv, as described by O'Donovan, an English 'correspondent,' contains a dense population, variously estimated from two to five hundred thousand, gathered in numerous villages, but without any central city. Since 1857, it has been in the power of the Tekke-Turcomans, who were then driven from Seraks on the Tedjend by the Persians. They are hospitable; but they are also cruel, deceitful, lying robbers. The men are poor workers; but the carpets, silks, and especially the silk embroideries, made by the women, are celebrated throughout Central Asia. The oasis is watered by the Murgab, which is raised by a dam, then divided into two arms, these into forty-eight branches, and finally into hundreds of canals: all these are under the control of the Tekke, who rent their use to the under tribes of the district. The possibility of Russian advance to this point is a question of much importance for the future of Central Asia. — (*Peterm. mittheil.*, 1882, 369, map.) [In this connection may be mentioned the accounts of Lessar's explorations in *Proc. roy. geogr. soc.*, iv., 1882, 486; v., 1883, 1; and of O'Donovan's, *id.*, iv., 1882, 345; and his book, The Merv oasis, London, 1882.] W. M. D. [130

BOTANY.

(Structural and physiological.)

New apparatus for respiration experiments. — This consists of a measured flask holding upon moist paper the seedlings under examination, and connected with a supply of oxygen in a balanced eudiometer. The evolved carbonic acid is absorbed by potassic hydrate in a small receptacle suspended within to the cork of the flask. The amount of oxygen consumed can be read off on the balanced eudiometer, which sinks in a bath of mercury as its contents disappear; the carbonic acid produced is ascertained from the potassic carbonate, and from subsequent treatment of the air in the flask at the close of the trial, by means of baric hydrate. A possible objection to this apparatus is the fact, that some time must elapse after it is arranged before the temperature of the flask and eudiometer can be precisely that of the surrounding air. Professor Godlewski has, however, found this error to be in point of fact unimportant. — (*Bot. zeit.*, Nov. 24, 1882.) G. L. G. [131

Basipetal development of leaves. — Trécul gives an account of the sequence in which the first vessels appear in Cruciferae, asserting that thereby his views as to the basipetal development of leaves are confirmed. — (*Comptes rendus*, Dec. 4, 1882.) G. L. G. [132

The structure of the leaves of heath. — Ernst Ljungström divides the species of Erica into four groups depending on the shape and microscopic anatomy of the leaves. Three types are, E. cupressina, E. stricta, and Calluna vulgaris. A fourth group comprises most of the Ericae proper. — (*Bot. notiser*, 1882, 178.) G. L. G. [133

Dispersion of Utricularia intermedia. — A few plants were thrown into a swamp at Oeleghem (Belgium) where the water was shallow. By the following year the species had covered several ares. Last March, M. Gilbert observed on the surface of the water minute vesicles blown hither and thither by the winds, and so abundant in amount as to have the appearance of green velvet. These proved to be detached bulblets of Utricularia intermedia formed of whorls of rudimentary leaves on an extremely short axis (see Gray's Manual, under Utricularia). After the development of the axis the air, hitherto entangled in the leaves, escapes, and the bulblet sinks to the bottom, where it speedily develops roots. M.

Gilbert notes also that this plant is also dispersed through the agency of the larvæ of caddisflies (a common bait used by anglers). The larvæ have an envelope composed of minute shells, bits of dead wood, fragments of plants, etc.; and sometimes this artificial carapace is furnished with five or six bulblets of Utricularia. These are borne about by the larvæ until at an early stage of growth they become detached from them, and then they take root in the earth at once. — (*Bull. soc. roy. bot. Bely.*, Dec. 28, 1882.) G. L. G. [134

Fertilization of Gerardia pedicularia. — Professor Bailey, who has already published several observations on the perforation of the flowers of this species by predatory humble-bees, has found that when few of these insects visit the flowers they are not so apt to perforate them. He concludes, with Fr. Darwin, that they only puncture flowers whose nectar they can reach normally, when competition forces them to work very rapidly. — (*Amer. nat.*, Dec., 1882.) W. T. [135

Spring floras. — The influence of temperature has been applied by Dr. Taylor to the explanation of vernal floras. Species that bloom early are frequently identical with, or closely related to, alpine species of the same latitude; and these, as is well known, bear a similar relation to arctic species. Alpine and arctic floras are commonly explained as remnants of the post-glacial flora, which have survived in consequence of the protection afforded by the cold of high altitudes or latitudes. Spring flowers are claimed to receive similar protection by their time of flowering. It is a suggestive fact, that when our early-flowering species also occur at high elevations, or farther north, they bloom much later than with us. — (*Nature*, Nov. 2; *Science gossip*, Dec., 1882; *Bot. gaz.*, Dec., 1882.) W. T. [136

Fall blooming of Menyanthes trifoliata. — This plant was found blooming abundantly in Rhode Island on the 23d of October, by Prof. W. W. Bailey. The swamp in which it grew had been desiccated by a long summer drought, which seems to have had upon it the effect of its normal winter rest, so that the following autumn rains and continued warm weather induced a season of general and vigorous bloom. — (*Coult. bot. gaz.*, Dec., 1882.) S. W. [137

(*Systematic and general.*)

Jamaica ferns. — A critical examination of the Jamaica ferns in the herbaria of the British museum and Kew, by G. S. Jenman, results in the addition of eight new species, with some not before credited to the island, and corrections in previous determinations. — (*Journ. bot.*, Nov., 1882.) S. W. [138

New American composite. — E. L. Greene redescribes from fuller material his proposed new genus, Holozonia, intermediate between Lagophylla and Hemizonia, of a single species (H. filipes), found in mountain streamlets east of Napa Valley, California. — (*Torr. bot. bull.*, Dec., 1882.) S. W. [139

Forest-trees of the gulf region. — A similar but more detailed account of the more important forest-trees in the States bordering the Gulf of Mexico, by Dr. Charles Mohr. — (*Ibid.*) S. W. [140

Origin of Cassia lignea. — The cassia districts of southern China have been recently visited by Mr. Ford; and the tree which is found to be cultivated there for the supply of Chinese cinnamon, or the cassia-bark of commerce, Professor Dyer of Kew identifies with the Cinnamomum cassia of Blume. An account of its cultivation, the preparation of the bark, etc., is given. — (*Journ. Linn. soc, Lond.*, Dec., 1882.) S. W. [141

ZOÖLOGY.

Coelenterates.

Nature of the green cells of Hydra. — The question whether any animals are able to produce chlorophyl is now attracting considerable attention; and as Geddes and others have stated that such animals as Hydra and Spongilla do have the power to vegetate their own intrinsic chlorophyl, Dr. Otto Hamann has made a careful examination of the manner in which the green cells make their appearance in the egg of Hydra. From the study of sections through the ovarian ovum at successive stages of development, he concludes that the green bodies are not developed in the egg, but that they make their appearance suddenly, and are full-grown as soon as they are found at all; that they migrate into the ovum, through the supporting layer from the endoderm. He thinks that the bodies which Kleinenberg described in the egg, as the early stages of the green cells, are in reality early stages in the development of the pseudo-cells.

Besides examining sections, he has removed the green cells from the body of the hydra, and has cultivated them in water; and he finds that when thus treated they thrive and multiply, and are apparently under conditions of life which are as natural as those to which they are exposed in the cells of the animal. They multiply rapidly in both cases by repeated division into fours. He states, on the authority of Dr. Dalmer, that the green bodies of Spongilla and Paramarcium also multiply by division into fours, and that they will thrive and multiply, like those of Hydra, in water. From these reasons, as well as from the fact that they are not formed by the egg of Hydra, but migrate into it, and from the fact that they have a cell-wall and nucleus, he concludes that they are algae; and he therefore accepts Brandt's conclusion, that, in every case where chlorophyl is present in animals, we have to do with unicellular algae, which are both morphologically and physiologically independent.

Brandt's statement that a green Hydra, when placed among specimens of the brown Hydra, inoculates them with its alga, and thus converts them into its own species, he disputes, on the ground that his own experiments in this direction failed, and also for the reason that the two forms are distinguished by many specific characteristics which have nothing to do with the presence or absence of the green bodies. He also doubts the propriety of giving specific names to these algae at present.

As regards the relation between the alga and its host, he believes that the Hydra derives no particular benefit from the oxygen given off by the algae, although it may digest them. He does not regard the alga as in any way dependent upon the Hydra. — (*Zeitschr. wiss. zool.*, xxxvii. 457.)

A directly opposite view regarding the nature of the green bodies of Hydra is advocated by William Marshall, who concludes, from the fact that they remained without change in a Hydra which was kept in the dark for six weeks, that they are not algae but are characteristic of the animal itself. He regards the green color of Hydra viridis as a protective resemblance to the fresh green plants among which it lives. — (*Ibid.* 665.) W. K. B. [142

Interesting observations on Hydra viridis. — The paper last noticed contains a number of facts regarding this species, which, although they are not strictly new, have never received due attention. Marshall has verified Baker's observation, made 140 years ago, that, when a parent Hydra is injured, one of the

buds may develop into a parent stock, while the original parent becomes separated, as a bud, from the body of its own offspring. He has also verified Trembly's discovery that Hydra sometimes multiplies by tranverse fission. He has rediscovered the so-called *anus*, which was described by Folkes in 1742, and by other observers of the last century. It is in no sense an anus, but simply the remnant of the channel of communication between the digestive cavity of the bud and that of the parent.

Baker's discovery, in 1744, that the two tentacles which first appear in the bud lie in the plane which passes through the axis of the body of the mother, has recently been verified by Mereschkowsky. Marshall not only finds that this is the case, but that the reproductive organs appear in the same plane. He also finds that when the tentacles of a full-grown specimen are cut off, the two which are first re-developed lie in this same plane. He therefore concludes that Hydra is in a certain sense, a bilateral animal.

His attempts to repeat Trembly's experiment of reversing a Hydra, failed completely, like those made by Baker and others; but a Japanese naturalist, Prof. Mitsukuri, has recently been more successful, and has verified Trembly's statement.

Marshall concludes that Hydra is, in a certain sense, both a hydroid polyp and a Scyphostoma. — (*Zeitschr. wiss. zool.*, XXXVII. 664.) W. K. B. [143

Anatomy and histology of Cyanea. — Dr. Lindenfeld gives a minute and profusely illustrated account of the general anatomy and the histology of a new species of Cyanea (C. Annaskala) from southern Australia. The paper is Part I. of a monograph on the Coelenterata of the South Sea. — (*Zeitschr. wiss. zool.*, XXXVII. 465.) W. K. B. [144

Mollusks.

The organ of Bojanus of the oyster. — Mr. P. P. C. Hoek, of the zoölogical society of the Netherlands, has recently published his investigations upon the generative organs and the organ of Bojanus of Ostrea edulis L., as observed by him at the zoölogical station of the society in Bergen-op-Zoom on the Escaut. He finds it to open into the pericardiac cavity, and also communicates with the generative openings on either side. Its principal cavity is a wide canal clothed with epithelial cells bearing very long cilia, communicating with numerous surrounding smaller cavities formed by induplicatures of membrane. This is believed to be its glandular portion. It lies close against the ventral side of the adductor, and extends into the substance of the mantle laterally. — (*Comptes rendus*, Nov. 2, 1882.)

The present writer, in the course of his investigations into the anatomy of O. virginica Gmel., has found a somewhat similar paired organ below the great double adductor. On either side it is partially embedded in the mantle; crescent-shaped, as seen from the side; frequently marked by brownish tissue in its walls; about five-eighths to three-fourths of an inch long, and a sixteenth to an eighth of an inch in width at its widest portion. In sections through this organ and the adjacent tissues of hardened specimens, the following details are revealed: A number of large central canals, clothed internally with epithelium bearing very long cilia, and communicating with smaller tubular cavities of irregular form, or with somewhat folded walls, lined with epithelium bearing shorter cilia. The inner non-glandular part embraced the parieto-splanchnic ganglia, sections of which appear in some of the preparations. The connection of the organ with the generative openings and pericardiac cavity was not traced. There can be little doubt but that what M. Hoek and myself have seen is really the renal organ of these animals. — J. A. B. [145

A remarkable molluscan type. — An interesting discovery has been made during a study by Mr. Dall of the deep-sea mollusks dredged off the Antilles by the U. S. coast-survey steamer 'Blake,' under the supervision of Prof. A. Agassiz. A living species of the genus Dimya Rouault is found attached to the margin of dead shells. This genus is fossil in the eocene of the Bos d'Arros, France, a deposit equivalent to that of the Paris basin. The type and sole recognized species until now was first figured by D'Archiac as an Anomia; and, in the same year, its true characters were recognized by Rouault. Since then the genus has attracted little attention, being barely mentioned in general treatises. It is traceable continuously through the formations on the Mediterranean, from the eocene to the pliocene; Ostrea tenuiplicata of Seguenza turning out to be a Dimya, closely allied to the original type of Rouault, to which, however, the recent form from the Antilles is still more similar, — indeed, practically identical. The interest of the discovery does not, however, lie chiefly in its ancient lineage, but rather in the remarkable characters of Dimya. It is practically an oyster, with two adductor muscles, and a pearly *outside* to its shell. It combines in itself features supposed to be characteristic of different orders of mollusks, and many separate groups within those supposed orders. The outer layers have a silvery nacre as in some oysters, like which Dimya has a porcellanous inner layer. The hinge has a pit like Hinnites or some pectens, roughened in one species as in Pseudamussium Verrilli. The branchiae are of a very primitive type, consisting of long disunited filaments attached to a cord-like band, forming a living fringe. Other and still more peculiar features require more study. It would seem as if the definite establishment of this genus gave the *coup-de-grâce* to the old order Monomyaria. — W. H. D. [146

Worms.

Structure and development of Dinophilus (a turbellarian). — Dinophilus is a marine rhabdocoelous planarian, resembling externally an annelid larva. A new species (D. apatris) was found in the marine aquarium of the zoölogical institute at Freiburg-im-Breisgau, and forms the subject of a valuable paper by Dr. Korschelt. The female is some thirty times larger than the male; is developed from large eggs, while the male is developed from a small egg. The structure of the female is described in considerable detail, especially as regards the histology. The most characteristic features of the female are the two bunches of setae on the front of the head, the constriction forming a neck, the five rings of cilia around the body, and the proboscis. This last is a *solid* mass attached to the base of a hollow sheath underneath the pharynx; when retracted the posterior end is bent upwards like the leg of an L. The sheath opens just inside the mouth. The proboscis is composed mainly of striated circular muscles, inside of which are longitudinal muscles. The tip is specially differentiated. The probosics can be thrust out and withdrawn with great rapidity, and probably serves to gather diatoms, etc., on which the animal feeds. It will be remembered that an organ similar in some respects exists in Prostomum, but cannot be regarded as homologous, for it lies above and not below the mouth. The male is not only smaller than the other sex, but shows a rudimentary organization; was observed to live ten days only, while the females were kept alive for months.

In the course of development two polar globules are formed. Segmentation is complete but unequal. There is a well-marked gastrula; the larva is completely formed, except the sexual organs, upon leaving the egg. Korschelt attempts to show a relationship of Dinophilus with the rotifers. (K. labors under several serious misapprehensions as to the characteristics of Rotifera.)—(*Zeitschr. wiss. zool.*, xxxvii. 315).

In a supplementary note he calls attention to the fact that Metschnikoff, in an article on the Orthonectidae (*Zeitschr. wiss. zool.*, 1881, 299), had previously made mention of the sexual dimorphism of Dinophilus. — (*Zeitschr. wiss. zool.*, xxxvii. 702.) C. S. M. [147

Parasites of elephants. — In spite of the importance of elephants as domestic animals, very little is known of their parasites. Cobbold has published a list of the species known at present, with descriptions and annotations. He mentions the following: Ascaris lonchoptera; Sclerostoma sipunculiforme; Strongylus clathratus; S. foliatus n. sp.; S. falcifer, n. sp.; Dochmius sangeri, n. sp.; Filaria Smithii, n. sp.; Amphistoma Hawkesii; A. ornatum, n. sp.; A. papillatum, n. sp.; Fasciola Jacksoni; making eleven species of helminths, besides which there are known three insect parasites, — a bot, Gastrophilus elephantis; a huge louse, Hæmatomyzus elephantis; and a mite, Homopus (Symbiotes) elephantis. The paper closes with a few practical considerations, of a necessarily desultory character, on the parasitic diseases of elephants. — (*Trans. Linn. soc. Lond., zoöl.*, I. pt. 4, 223.) C. S. M. [148

Insecta.

Coleoptera of Cincinnati. — A supplementary list of 167 species is added to the 1,419 of his earlier catalogue by C. Dury. No notes are added. — (*Journ. Cinc. soc. nat. hist.*, v. 218). [149

Rearing Tortricidae. — Some good hints as to the best means of rearing larvae of this group are given by C. G. Barrett; the main secret of course being how longest to preserve succulent leaves from either moulding or withering when removed from the plant. — (*Ent. monthl. mag.*, No. 224.) [150

Transformations of Endotricha flammealis. — An excellent life history of this pyralid moth is traced with care by W. Buckler, the transformations being previously unknown. The eggs are laid in varying situations late in July; the caterpillar, which is strongly given to cannibalism when reared in confinement, hatches early in August, and in September conceals itself, when not feeding, in a singular web; this is partitioned into several chambers, often as many as from three to five, one above the other, openly wrought, the larva occupying different chambers indiscriminately, curled tail over head. The larva generally hibernates, becomes full fed in May, and appears on the wing in July. — (*Ent. monthl. mag.*, No. 223.) [151

Moths of New Mexico. — A list of 98 species collected by F. H. Snow is given by A. R. Grote, with descriptions of new forms, and preceded by some general remarks. He finds an admixture of subtropical forms, with some "representatives of European species not yet found near either our western or eastern seaboards," mentioning particularly a species of Copimamestra. A summary of the characters used in establishing genera in the Noctuidae, the author's special study, is added. — (*Ann. mag. nat. hist.*, Jan., 1883.) [152

Oviposition in Argynnis. — Dr. Henry Skinner called attention to a curious departure from the usual habit of lepidoptera in the case of Argynnis Cybele, which drops its eggs from a height upon grass and violet leaves, instead of depositing them, as in the case of all other species known to him, upon the leaves of the plant upon which the insect is to feed. — (*Acad. nat. sc. Philad.; meeting* Jan. 23.) [153

VERTEBRATES.

Destruction of red blood corpuscles in the liver. — It has long been supposed that the red blood globules were to a great extent broken up in the liver, giving rise, among other things, to the bile pigments. The experimental proof, however, has been unsatisfactory. R. Nicolaides finds on careful enumeration, by Melassez's method, of the corpuscles in blood drawn from the portal and hepatic veins of rabbits, dogs, and cats, that the number is always much less in the hepatic vein. — (*Archiv. de physiol.*, x. 1882.) H. N. M. [154

Electrical irritability of the spinal cord. — Schiff contributes new experiments on this much-disputed point. His general conclusion is, that no directly irritable elements can be demonstrated in the spinal cord, apart from the paths of the nerve-roots. — (*Pflüger's archiv*, xxix. 1882.) H. N. M. [155

Uses of the bile. — From observations made on dogs with biliary fistulae, and carefully prevented from licking up the outflowing bile, F. Röhman concludes that the ill results of excluding this secretion from the intestine have been over-estimated. His animals, when fed on dog-biscuits, remained apparently normal in all regards for weeks: no diarrhoea nor signs of unusual putrefactive decompositions in the intestine occurred; nor did ill results follow adding a moderate amount of flesh or of fat to the diet. Much flesh or fat, however, caused digestive disturbances after a few days. When soap was given, these were very marked and severe. The intestine deprived of bile can very well serve to do all necessary for the maintenance of the bodily functions; but it is so far in an abnormal state as to have its power of resisting injury, or indiscretion in diet, greatly diminished.

As regards the absorption of fats, he finds, as others, that this is much diminished when the bile is drained off through a fistula. Very little of the unabsorbed fat, however, leaves the body as such; the greater part of it being broken up, so that the excreta contain much free fatty acids. Possibly the unusual accumulation of these in the intestine is the immediate cause of its special liability to lesion. — (*Pflüger's archiv*, xxix. 1882.) H. N. M. [156

Birds.

Contributions to the anatomy of birds. — The osteological papers of Dr. Shufeldt, originally printed in the twelfth annual report of the U. S. geological survey, have also been separately published. The papers on the burrowing owl, the horned lark, the Tetraonidae, and the shrike, need but little comment, since they have been published some time. We notice, however, the addition of woodcuts of the live birds, and certain changes in the text.

The last paper, that on the Cathartidae, is of much later date. The descriptions are based on a good supply of skeletons in the Smithsonian museum and in the Army medical museum. They are illustrated by several plates and woodcuts. Special points of interest are the extensive air-canals, the solidity of the atlas, the variations of the sternum in the same species, the presence of a claw on the ungual phalanx of the first digit. The author finally concludes that the present division into genera is justified from an osteological point of view. He also agrees that there is no close relationship between the old and new

world vultures, the former being a group of the Galconidae. — J. A. J. [157

Lymph-hearts in the embryo chick. — From the observations of Panizza, Meyer, and Stannius (*Müller's arch.*, 1843, 452), it is known that lymph-hearts occur in various birds, but they have not hitherto been observed in gallinaceous forms. In structure they vary from a rudimentary to a functionally perfect condition. These facts lead Dr. Albrecht Budge to consider it probable that they are always developed, and when absent in the adult, have been atrophied. Upon investigation he succeeded in finding them in the embryo chick. He was successful in injecting the lymphatics in embryos from ten days old upwards. There are two hearts on the back, between the coccyx and pelvis. They enlarge until the time of hatching, after which they both disappear, although one is frequently lost sooner. Small vessels connect them with the *vena hypogastrica* on the one hand, and with the lymphatics, especially of the allantois, on the other. The heart is lined with an endothelium, and its wall is composed of connective tissue and spindle-shaped muscle cells. The organ pulsates independently of the blood-pulse, under favorable circumstances, sixteen times a minute: the pulsations could be first seen on the eighth day. The dissecting out of these hearts is difficult, as soon after the twelfth day they become covered by fat. — (*Arch. anat. physiol., anat. abth.*, 1882, 350.) C. S. M. [158

Mammals.

Fossil peccary from New York. — Dr. Jos. Leidy described two skulls and several portions of the skeleton of a fossil peccary from New York. The remains belong to Platygonus compressus, and were in a state of such remarkable preservation as to appear recent. — (*Acad. nat. sc. Philad.; meeting* Jan. 23.) [159

The phylogeny of the Sirenia. — Prof. E. D. Cope described a portion of the jaw of a large sirenian mammal, containing an incisor tooth or tusk, characteristic of the genus Halitherium. The specimen was from the vicinity of Charleston, S.C. It exhibits the peculiarity of possessing, exterior to the tusk, a second large tooth, which is probably also an incisor. This character was believed to distinguish the form generically from the other members of the order, and the name Dioplotherium was proposed for the genus thus defined. The species was named D. Manigaulti; and, from the proportions of the parts preserved, it was believed to have been rather larger than a dugong.

The genus furnishes a first step in tracing backwards the phylogeny of the Sirenia. These animals doubtless present the same phenomenon as that witnessed in the lines of the rhinoceroses, ruminants, and some others; viz., — a gradual reduction in number, and final extinction, of the superior incisor teeth. In Rhytina the extinction is complete; in Halicore, one remains. Dioplotherium, with two, forms the passage to the primitive types, not yet known, which possessed three. They are considerably specialized in the present genus, and a reduction of size is to be looked for in the first genera of the Sirenia. — (*Acad. nat. sc. Philad.; meeting* Feb. 5.) [160

Synovial membranes. — A monograph of their development and structure, by Oscar Hagen-Torn, has just appeared. A fissure arises by the degeneration of cells between the cartilages. The surrounding connective tissue with many but not essential changes from the embryonic cellular condition of the neighboring mesoderm becomes the synovial membrane. The enlargement of the fissure is attributed to movements of the joints. In extra-uterine life the synovialis disappears at the points of great pressure, is thinned out where there is a medium pressure, and acquires the papillose character on the other parts, which are especially exposed to the influence of the negative pressure which arises during the articular movements. — (*Arch. mikr. anat.*, xxi. 591.) C. S. M. [161

Embryology of the milk-glands. — G. Rein summarizes the results of his extended researches on the development of the milk-glands. The same type of formation was found in all the species investigated. Gegenbaur has maintained, that the majority of mammals have their teats formed by an upgrowth of the area in which the lactic glands are developed; but that in ruminants there is another type, the glandular area forming a depression, the walls of which grow up around it into a teat. Rein, however, demonstrates that the ruminants conform to the usual development. His investigations may be summarized as follows: The first trace of the milk-gland appears very early, usually when the visceral clefts are closed; in man, during the second month. The gland first appears as an ingrowth of the epidermis. The connective tissue of the nipple is next formed; the teat may be developed early (ruminants, horse, etc.), or at the end of fœtal life (man). Next secondary outgrowths arise from the primitive epidermal bud, as many as there are ducts in the adults. At this period the differentiation of the stroma from the mesoderm begins. Most of the primitive ingrowth disappears, a little remaining as the common orificial duct. The secondary epithelial growths, on the other hand, grow farther, become tubular, branch, and finally form the ducts (sinus and ducts proper) and the acini. In the human fœtus all the parts of glands are developed by the time of birth. The development is according to this same plan in all the animals investigated, comprising species of Primates, Insectivora, Carnivora, Ungulata, Glires, and Didelphyda. The so-called Montgomery glands are rudimentary milk-glands. The view advanced by Creighton and Talma, that the acini are developed from the mesoderm, is incorrect. The milk-glands cannot be regarded as modified sebaceous glands, but are organs *sui generis*. — (*Arch. mikr. anat.*, xxi. 678.) C. S. M. [162

Distribution of the genus Macroscelides. — According to M. J. Huet, this genus, as now known, ranges over all Africa, except the western portion between the tropics of Cancer and Capricorn. — (*Mission G. Révoil aux pays Çomalis.*) F. W. T. [163

Anatomical and external characters of Zalophus gillespii. — W. A. Forbes publishes two chromolithographs of the exterior of the Californian sea-lion, and the following notes together with others: No true scrotum; four inguinal mammae; no under fur; tongue bifid at the apex; stomach less globular and more elongated than in Otaria jubata; intestines much longer, and liver less differentiated, than in the latter species; an innominate gives off right and left carotids close together; trachea very wide; spleen flattened and elongated; kidneys compound. The color of the fur is described at length, and measurements are given. The full-length figures in the first plate strike one as being unnaturally stiff. — (*Trans. zoöl. soc. Lond.*, xi. 1882.) F. W. T. [164

Mammals of Essex Co., England. — Notes by H. Laver upon forty species, including seven cetaceans and the seals Phoca vitulina and Cystophora cristata. — (*Trans. Epping Forest nat. club*, ii. 1882, 157.) F. W. T. [165

Man.

Age of the mother, and sex of the child. — According to Schramm and Bidder, it appears that we may consider twenty to be the age of the most perfect female maturity; that it is at that age that women bear the largest proportion of girls; that, the farther they pass beyond that age, the more the proportion of the male to the female children increases. Rumpe deals with this question, especially as regards primiparae. He divides his cases into those where the mother was under thirty (young), and those over (old). For the old primiparae, Rumpe had 63 boys against 52 girls, or 121 : 100.

Other authors have found as follows, for *old* primiparae: —

	Boys.	Girls.
Schramm	132	100
Ahlfeld	137	100
Hecker	133	100
Krüger and Winckel	133	100

The mean proportion of all births, independent of the mother's condition, is 106 boys to 100 girls. If this increase in the relative number of boys depends on the age of the mother, then it must be the case also with multiparae. Rumpe cites 400 cases to show that it is so: 200 multiparae under thirty gave birth to 96 boys and 104 girls; i.e., 92 : 100; 200 multiparae over thirty gave birth to 110 boys and 90 girls; i.e., 122 : 100. The conclusion is therefore confirmed, that, the older the mothers, the larger the proportion of boys born. — (*Arch. f. gynoek.*, xx., 1882, 129.) C. S. M. [166

Asymmetry of the turbinated bones in man. — According to Dr. H. Allen, this may exist independently of or involving the nasal septum, and is probably due to pre-natal influences. — (*Proc. acad. nat. sc. Philad.*, 1882, 239.) F. W. T. [167

PEDAGOGY.

The use of slates. — Prof. H. Cohn of Breslau believes that the use of slates by school-children tends to produce short-sightedness; and would substitute either pen and ink, or an artificial white slate with black pencil manufactured in Pilsen, and already introduced into a few German schools. In 1878 Horner found (*Vierteljahrschrift öffentl. gesundheitspflege*, x. 4), that B and E could be read, if black on white ground, 496 cm.; if white on black, 421 cm.; and if gray on black, 330 cm.; and ascribed the greater difficulty with white letters to irradiation. The reflection of light from the surface of slates is, it is said, enough alone to cause their disuse. The school-board of Zürich has forbidden the use of the slate after the first term (primary year), and many teachers and oculists advocate the substitution of white-boards for black-boards. The noise of slates; dirty habits formed by erasures; bad positions favored by reading the less legible script; a heavy hand; and the habit of twisting learned with a pencil, and to be unlearned with a pen, — these, it is said, are obviated by the use of pen and ink at the outset. The obvious objections are, that children can occupy themselves better with slates, and from pencil to pen is from the easier to the harder. — G. S. H. [168

Curriculum in Prussian gymnasia. — The most important changes in the recent revision of the study-plans of the Prussian gymnasia, which had remained essentially unaltered between 1856 and 1882, are as follows: 1. One hour per week less of Latin during the first five, and two less during the secunda years. Greek begins one year later, but for four years gains an hour per week. Writing and religion receive also less time. 2. What is thus gained is divided nearly equally between French, history and geography, mathematics, physics and natural science, and drawing. Save in the reduction of Latin, the change is slight, but significant, and much discussed, as a departure towards the plan of the real-school. — G. S. H. [169

School savings-banks. — The advisability of school savings-banks elicits much discussion in Germany. On the one hand, it is claimed that pupils may be taught self-denial, foresight, interest in great mercantile and other operations remote from their own narrow lives; encouraged in bookkeeping; saved from the noxious effects of bad confectionery; if poor, encouraged in helping their parents; and ideality and healthful moral sentiments cultivated by directing their plans for future use of their money to beneficent objects. On the other hand, the opponents of school-banks urge, that they encourage a commercial view of life prematurely; that, as school-children seldom earn money, they will be stimulated to tease or steal it from their parents or others, when, to be properly possessed, money should be earned; and that this is not the most pedagogic method of instruction. The plan has perhaps been most fully tried in Ghent, where, out of 15,392 scholars in the lower schools, 13,032 have accounts in the school savings-banks of the place; the average for each depositor being about 35 francs (seven dollars). — G. S. H. [170

Herbart's works. — The first volume of a new edition of Herbart's works, just published by Veit & Co., contains his pedagogical writings. As Herbart was the first to attempt to give a scientific character to pedagogy, and a more or less philosophical one to Pestalozzi's incoherent insights, his historic significance is great; although advance has been made beyond his position by his followers in pedagogy (Beneke, Diesterweg), as well as by his philosophical disciples. A number of critiques and other interesting *inedita*, the existence of which seems to have been unknown to the compilers of the former Hartenstein edition, add considerably to the value of the new edition. — G. S. H. [171

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

National museum.

The fisheries exhibition. — Mr. T. W. Smillie, photographer of the museum, is preparing a series of photographs to accompany the fisheries exhibit, which will be sent to London in the spring. The views, many of which are those of fishing-vessels and boats in motion, were taken by an instantaneous process. The positives, which measure 30 × 40 inches, and are, perhaps, the largest photographs ever taken for display without crayoning, are obtained by aid of the electric light. The rays from a Brush lamp are passed through an achromatic condenser 13½ inches in diameter, thence through a negative and through a large portrait-lens; they are then thrown upon a screen placed at a distance of 7 or 8 feet from the camera. A sensitized sheet of paper, of dimensions a little

exceeding those given above, is hung on the screen, and exposed for 15 or 20 minutes. The picture is developed by pyrogallic acid, and fixed by hyposulphite of soda.

Lighting the museum. — Experiments are being made with a view to lighting the museum building by electricity.

The ceramic collection. — A magnificent Sèvres vase 3½ feet in height was recently given by Mr. Lazarus Strauss of New York. It is one of the finest products of the Sèvres pottery, and was valued in France at 6,000 francs.

Thin sections of anthracite coal. — Mr. G. P. Merrill, of the department of rocks, who spent some time in the attempt to prepare transparent sections of anthracite coal for the microscope, has abandoned the enterprise as being outside the limits of possibility. So far as his experience goes, the sections offered by dealers are of imperfectly carbonized wood-nodules and other similar substances.

Naval observatory.

Ephemeris of the great comet, b. 1882. — Computed from elements (Nature, 688), and reduced to the mean equinox, 1883.0.

GREENWICH MEAN NOON.

	R. A.	Declination.	Log. r.	Log. Δ.
1883.	h. m. s.	° ′ ″		
Feb. 10.0	6 0 37.8	19 41 17	0.48137	0.38891
14.0	5 57 40.4	18 40 13	0.48909	0.40520
18.0	5 55 19.7	17 41 17	0.49669	0.42132
22.0	5 53 32.7	16 44 35	0.50413	0.43723
26.0	5 52 14.7	15 50 14	0.51133	0.45282
March 2.0	5 51 24.4	14 58 16	0.51841	0.46817
6.0	5 50 58.7	14 8 43	0.52532	0.48322
10.0	5 50 54.8	13 21 37	0.53200	0.49790
14.0	5 51 12.3	12 37 0	0.53861	0.51231
18.0	5 51 47.9	11 54 52	0.54508	0.52635
22.0	5 52 39.5	11 15 10	0.55135	0.53995
26.0	5 53 46.1	10 37 56	0.55751	0.55316
30.0	5 55 6.1	10 3 6	0.56354	0.56594
April 3.0	5 56 38.1	9 30 34	0.56944	0.57828
7.0	5 58 20.9	9 0 19	0.57520	0.59015
11.0	6 0 13.9	8 32 21	0.58090	0.60158

E. FRISBY, *Prof. Math., U.S.N.*

Washington, Feb. 10, 1883.

Note. — In the published elements, ϕ should be 89° 13′ 42″.70, instead of 89° 7′ 42″.70.

(Communicated by Vice-Admiral Rowan, Supt. U. S. naval observatory.)

Department of agriculture.

Anthrax or charbon. — In December last Mr. Charles J. Whitmore of Boston addressed a letter to the commissioner, stating that the Vicomte de Coettogan had obtained the concession of the use of the Pasteur method of vaccination for America, and desired to ascertain: 1°, whether charbon-fever exists in the United States; 2°, whether Pasteur's method could be introduced here with vaccine from Pasteur's laboratory; and, 3°, whether such introduction would prove profitable to the introducer.

The commissioner referred the letter to Dr. D. E. Salmon of the veterinary corps of the department, who reports as follows: —

1. In the northern and western states, charbon-fever occasionally occurs on isolated farms among cattle; but it is not known that sheep are very often affected. The same is true of many of the southern states; but in the gulf states, and especially in the lower Mississippi valley, charbon at times becomes extremely destructive to all kinds of domestic animals, especially after great inundations. Heavy losses in stock experienced in certain years in Tennessee, Arkansas, Missouri, etc., may or may not have been caused by charbon; no competent investigation having been made.

2. This question is not so easily answered, as it involves, first, the bringing the vaccine from France, and keeping it here until needed; secondly, the determination of the strength which should be originally given it to make it safe for *our* animals; thirdly, public experiments to convince our farmers of the usefulness of the vaccination.

Pasteur's method requires the use of two vaccines of different strengths, which cannot be kept stable for any length of time; the weaker vaccine becoming ineffective, while the stronger virus frequently produces fatal results. This has been proven by experiments in different parts of France, in Germany, and England, made partly by Pasteur's assistants. Moreover, Pasteur himself admits that the animals of different countries are of various degrees of susceptibility, and that he had to vary the strength of his vaccine to suit the constitution of the animals. To determine the comparative susceptibility of American animals, would alone be a work of considerable magnitude and expense, requiring at different points a number of such public experiments as were made in France.

3. The introduction of the method by private persons with any idea of profit would therefore probably be doomed to failure; but as the preparation of the charbon vaccine is no secret, the establishment by the general government of a laboratory for the preparation and free distribution of the vaccines for charbon and other contagious diseases of animals would seem to be desirable.

PUBLIC AND PRIVATE INSTITUTIONS.

Boston society of natural history.

Teachers' school of science. — This department of the society has become well known to Boston people by its efforts for the education of teachers since its inception in 1871. During some winters several courses of lessons have been given to large audiences, which were accompanied by other laboratory series with smaller audiences, on subjects ranging throughout the physical and natural-history branches of knowledge.

The present winter's work consists of only two courses: one of ten lessons on physical geography, by Prof. W. H. Niles; and one of five on physiology, by Dr. H. P. Bowditch.

Prof. Niles's course has been eminently practical, and is much praised by the teachers in attendance; who say that he gives them trustworthy and original views, and modes of treating the subject, which they can use in their school-work. Dr. Bowditch will probably carry out the same plan as last year, in which he was equally successful in showing teachers how to use the bodies of their own pupils in such simple physiological experimentation as is needed in the public schools.

The larger public courses have been for two years under the patronage of the Lowell fund, of which Mr. Augustus Lowell is trustee; and his liberality in allowing the use of Huntington Hall on Saturdays has enabled the curator of the Society, Prof. Alpheus yatt, to re-organize the management, and extend

the benefits of the lessons to all towns near Boston. The school now has agents interested in the proper distribution and use of its tickets, not only in Boston, but also in the larger number of the suburban towns which cluster around that municipality.

The following statistics of this winter's courses will speak for themselves with regard to the probable benefits of this extension of its efforts over a wider field: —

Subjects.	Applications received.	Tickets sent.
Physical geography	988	1,098
Physiology	834	945
	1,822	2,043

Distribution of Tickets.	Phys. geog.	Physiol.
Boston	364	302
Neighboring towns (45)	589	512
Complimentary, school authorities and private persons	145	131
	1,098	945

Grade of teachers: Superintendents, 10; sub-masters, 24; principals, 157; assistants, 847. The average attendance so far upon the first course has been from six to seven hundred.

The school has also had another branch in active operation, in which the courses are paid for by the teachers themselves. The curator, assisted by Mr. Van Vleck, has had two classes in zoölogy occupying four winters, and numbering in all fifty-nine teachers; Mr. B. H. Van Vleck, a class in physiology numbering fifteen teachers; and Mr. W. O. Crosby, a special class in geology. These classes have demonstrated a demand for the kind of knowledge offered, so earnest that a good proportion of the teachers have been willing to surrender their holidays to laboratory work, and also to pay for the privilege. A number more would have attended but for the obstacle of the fee necessarily charged for tuition. These classes, now that the reality of this demand has been shown, should be placed on a more liberal basis, and one more consistent with the usual policy of the society with regard to the needs of our public schools. Owing to a combination of causes which it would be useless to detail, these laboratory courses formerly given every Saturday throughout the winter have been discontinued during this season. It is intended to resume them as soon as practicable.

Academy of natural sciences, Philadelphia, Penn.

Instruction in mineralogy and lithology. — At the close of Prof. Heilprin's lectures, Prof. H. Carvill Lewis will deliver a course of instruction in mineralogy and lithology, a large portion of which will consist of a series of field-lectures upon the mineralogy and lithology of Philadelphia and vicinity. In addition to lectures at the academy, and alternating with them, there will be about ten short excursions to interesting localities in the neighborhood of the city, where the strata and their enclosed minerals will be studied in place, and practical methods given for recognizing both rocks and minerals and their relation to the geology of the region. The specimens collected in the field will be more carefully examined and studied with laboratory practice at the academy at the lecture following each excursion.

The introductory lecture will be delivered on Tuesday, April 17, 1883, in the lecture-room of the academy, at 4.15 P.M.; and the lectures will continue at the same hour on successive Tuesdays and Fridays. The field-lectures, commencing early in May and continuing until July, will take place on Fridays (weather permitting), and will occupy the greater part of the day.

Among the localities visited will be the quarries of hornblendic gneiss at Germantown and Frankford, the soapstone quarries on the Schuylkill, the limestone and marble quarries, and the iron-mines of the Montgomery County Valley, the lead, zinc, and copper mines near Phœnixville, the mineral localities of Delaware County, etc.

NOTES AND NEWS.

— The description of the fossil remains of the remarkable flying reptile, Rhamphorhynchus phyllurus Marsh, which was given in the American journal of science in April, 1882, has been supplemented by the liberal distribution of casts of the original by Prof. O. C. Marsh. These are faithful representations in all the more important characteristics prominent enough to make their re-appearance upon a plaster casting. The wings and caudal paddle are the most important features, and render this fossil unique of its kind. The wings are particularly well rendered, and perfectly distinct in outline and details. The steering-paddle at the end of the long, attenuated tail, and the tail itself, is distinct in outline, but deficient in details; the bones of the hands are also in the same state, all these parts being very small.

Professor Marsh, in distributing these and other casts of his rare and remarkable fossils, has added very greatly to the usefulness of his own work and the diffusion of knowledge, besides setting a shining example of scientific liberality. He has, we know, in several instances, and we presume in all cases, demanded no exchange of any kind. Many institutions now have the means of placing before visitors and students the actual condition of the fossil remains of one of the most remarkable of the extinct Jurassic reptiles. This is so nearly perfect that it shows there is no exaggeration in the restoration accompanying Professor Marsh's descriptions, which represents this pterodactyle flying through the air with its wings expanded.

— The following persons were elected officers of the biological society of Washington, on Jan. 5: President, Prof. C. A. White; Vice-Presidents, Prof. C. V. Riley, Prof. Lester G. Ward, Mr. William H. Dall, Prof. Theodore Gill; Secretaries, Mr. G. Brown Goode, Mr. Richard Rathbun; Treasurer, Dr. Tarleton H. Bean; Members of Council, Dr. George Vasey, Dr. D. Webster Prentiss, Prof. Otis T. Mason, Mr. Frederick W. True, Dr. Elliott Coues.

— At the meeting of the Albany institute held Jan. 16, officers of the institute at large and of its three departments were chosen for the ensuing year. The following, by virtue of their offices, constitute the executive committee provided for by a recently adopted by-law: President, Orlando Meads, LL.D.; Treasurer, John Templeton; Recording secretary and libra-

rian, Daniel J. Pratt, Ph.D.; Corresponding secretary, Leonard Kip; President of first department and one of the vice-presidents of the institute, David Murray, LL.D.; President of second department and one of the vice-presidents, J. A. Lintner; President of third department and one of the vice-presidents, Henry A. Homes, LL.D.

— Some oysters have recently been received by Lieut. Winslow of Washington, from Barnegat, N.J., which seem ready to spawn, — an unusual condition of matters, since the spawning season at that latitude is supposed to be at an end in August.

— The bronze statue of Professor Joseph Henry, by W. W. Story, has arrived in America. The ceremony of unveiling will take place upon the grounds of the Smithsonian institution in April, during the session of the National academy of sciences.

— The annual meeting of the regents of the Smithsonian institution was held in Washington on Jan. 17. All the regents were in attendance except Dr. Noah Porter and Mr. Peter Parker. Professor Baird reported upon the state of the finances as follows: receipts for 1882, $67,435.52; expenditures, $37,798.07; balance available to July 1, 1882, $29,637.45. At the suggestion of Dr. Maclean, Professor Baird was appointed to collect and publish the scientific writings of Dr. Henry.

— Dr. Orville Derby, curator of geology in the national museum of Brazil, has recently arrived in Washington. He will complete the arrangements for the publication of the results of the geological survey of Brazil, organized under the late Prof. C. Fred. Hartt. Dr. C. A. White is preparing the report on the cretaceous mollusks and echinoderms. He has already completed the sections of conchifers, gasteropods, and cephalopods. Twenty-four quarto plates are drawn and finished. Ninety per cent of the species are new. Three new genera of gasteropods have been described. The whole work upon invertebrates will comprise as much matter as has been hitherto published on the same subject for all South America, and will undoubtedly form an epoch in the development of the invertebrate paleontology of that continent.

— At the meeting of the Boston society of natural history on Feb. 7, Dr. M. E. Wadsworth gave some instances of atmospheric action on sandstone. Mr. Lucien Carr discussed the social and political position of woman among the Huron-Iroquois tribes, and Mr. John A. Jeffries spoke of the dermal appendages of birds.

— At the meeting of the Appalachian mountain club Feb. 14, Mr. W. H. Pickering exhibited, with the lantern, photographic views taken during the club's recent excursion to the White Mountains; and Mr. J. Tatlock, jun., read a paper on the principal coefficients in the barometric formula of Laplace, as applied to the White-Mountain region.

— At the thirty-second annual meeting of the Michigan state teachers' association, held at Lansing, Dec. 27-29, papers were read by J. S. Crombie on The need of visible illustration, and the proper use of apparatus; by H. R. Pattengill, on Science in primary schools; and by Prof. V. M. Spalding, on The microscope in our public schools. An exhibition of microscopic objects and apparatus took place at the evening session the first day.

— At a meeting of the American philosophical society, held at Philadelphia on Feb. 1, Prof. J. T. Rothrock read a paper on Some microscopic distinctions between good and bad timber of the same species.

— The American institute of mining engineers will hold its annual meeting in Boston next week. The opening session will be at the Brunswick hotel on Tuesday evening, when addresses of welcome will be given by Mr. Edward Atkinson, and, on behalf of the Boston society of civil engineers, by Mr. Thomas Doane. Papers will be read at this session as well as at the sessions held on Wednesday and Friday at the Massachusetts institute of technology, and on Thursday afternoon at Sever hall in Cambridge. Excursions will be made on Wednesday, to the Leavitt pumping-engine, the Carson sewer-excavating apparatus, and the Norway iron-works; on Thursday, to the Watertown arsenal to inspect the U. S. testing-machine, and to Harvard university; after the session, to Lowell and to Worcester to visit the manufactories and institutions of those cities. The subscription dinner is to be at the Brunswick, at eight o'clock on Thursday.

The following papers have been announced: Gas-producer explosions; by P. Barnes, Elgin, Ill. — Microscopic analysis of the structure of iron and steel; by J. C. Bayles, N. Y. — Metallurgy of nickel in the U.S.; by W. P. Blake, New Haven. — The mining regions about Prescott, Arizona; by John F. Blandy, Prescott. — The collection of flue-dust at Ems; by T. Egleston, N.Y. — The eozoic and lower paleozoic in South Wales, and their comparison with their Appalachian analogues; by Dr. Persifor Frazer, Philadelphia. — Note on the geology of Egypt, with especial reference to the rocks from which the obelisks have been taken; by Dr. Persifor Frazer. — Notes on a protected iron hot-blast stove; by Frank Firmstone, Easton, Penn. — The shop treatment of structural steels; by A. F. Hill, N. Y. — A suggestive cure for blast-furnace chills; by H. M. Howe, Boston. — Coal and iron of Alabama; by T. Sterry Hunt, Montreal. — Lines of weakness in cylinders; by R. H. Richards, Boston. — The strength of American woods; by S. P. Sharples, Boston. — Determination of manganese in spiegel; by G. C. Stone, Newark, N. J. — History and statistics of the manufacture of coke; by J. D. Weeks, Pittsburg, Penn. — Notes on settling-tanks in silver-mills; by Albert Williams, jun., Washington.

— That most enterprising of our scientific societies at the west, the Davenport academy of natural sciences, is about to complete the third volume of its 'proceedings' by the publication of the memoir on Solpugidae nearly completed by its late president, J. D. Putnam, a young naturalist of rare promise and industry. The publishing committee, with commendable enterprise, are endeavoring to procure sufficient subscribers to the number to pay the cost of publication, and have already secured 140 of the 180 required. Mr. Putnam's paper is edited by Prof. H. Osborn, of Ames, Iowa; and its four plates engraved under the superintendence of Dr. H. A. Hagen of Cambridge. A portrait of Mr. Putnam will accompany the paper.

— At the meeting of the Biological society of Washington, Feb. 2, an adjourned discussion of the presidential address took place; Dr. Elliott Coues read a paper on Zoölogical nomenclature applied to histology; and Prof. O. T. Mason, on the Human fauna of the district of Columbia.

— The January number of the Harvard university bulletin, recently issued, commences a new volume. We miss the 'notes' which formed such an admirable feature of the last volume, but are glad to know that they will again be resumed. Two pages and a half are given up to the accessions to the University library in science, in which we note a collation of the copies of the several volumes of Wilkes's exploring expedition in the libraries of Cambridge and vicinity. Of interest to scientific men are Mr. Bliss's classified index to the maps in Petermann's mittheilungen (six pages more of which are given), and Mr. Winsor's commencement of a bibliography of Ptolemy's geography.

— No. 4 of the Library of Cornell University for January contains fourteen additional pages of the valuable classed list of the rich collection of works relating to mathematics in that institution, making forty-five pages so far published. Both main and subordinate topics are arranged alphabetically; and the present instalment completes astronomy, and gives, in addition, calculus, engineering, functions, etc., and enters geometry.

RECENT BOOKS AND PAMPHLETS.

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Boston. — Archæological institute of America. Bulletin, i. Bost., *Williams.* 1883. 40 p. 8°.

Cohn, F. Die pflanze. Vorträge aus dem gebiete der botanik. Breslau. 1882. 8°.

Crowther, J. The unwritten record; a story of the world we live on. With an introductory note by J. R. Macduff. Lond., *Sunday School Union.* 1883. 178 p. 8°.

Delattre, C. Étude sur les gisements français de phosphate de chaux; note sur la décomposition du phosphate bicalcique par l'eau. Paris, *imp. Davy.* 1882. 80 p. 8°.

Delaurier, E. Essai d'une théorie générale supérieure de philosophie naturelle et de thermochimie, avec une nouvelle nomenclature binaire notative pour la chimie minérale et organique. Fasc. i. Paris, *imp. Lahure.* 1882. 82 p. 8°.

Dunman, T. Talks about science; with a biographical sketch by C. Welsh. *New ed.* Lond., *Griffith.* 1883. 250 p. 8°.

Dreyfus-Brisac, E. De la liberté d'enseignement. Paris, *Masson.* 1882. 46 p. 8°.

Geikie, A. Geological sketches at home and abroad. Lond., *Macmillan.* 1882. 8°.

Harting, J. E. Essays on sport and natural history. Lond., *Cox.* 1883. 490 p. illustr. 8°.

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Morel, C., et **Duval,** M. Manuel de l'anatomiste. Paris, *Asselin.* 1883. 14+1152 p. illustr. 8°.

Nadaillac, *marquis* de. L'Atlantide et les oscillations de l'ecorce terrestre. Paris, *Gervais.* 1882. 24 p. 8°.

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Oppolzer, T. von. Lehrbuch zur bahnbestimmung der kometen und planeten. 2. *aufl.* 1 bd. Leipzig, *Engelmann.* 1882. 12+683 p. 8°.

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Simony, Friedrich. Gletscherphänomene. Wien, *Hölzel.* 1883. 24 p., pl. 8°.

Stitzenberger, E. Lichenes helvetici eorumque stationes et distributis. Fasc. i. St. Gallen, *Köppel.* 268 p. 8°.

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